

Figure 10.1-1
 Portland Harbor RI/FS
 Remedial Investigation Report
 Major Elements of the Portland Harbor CSM

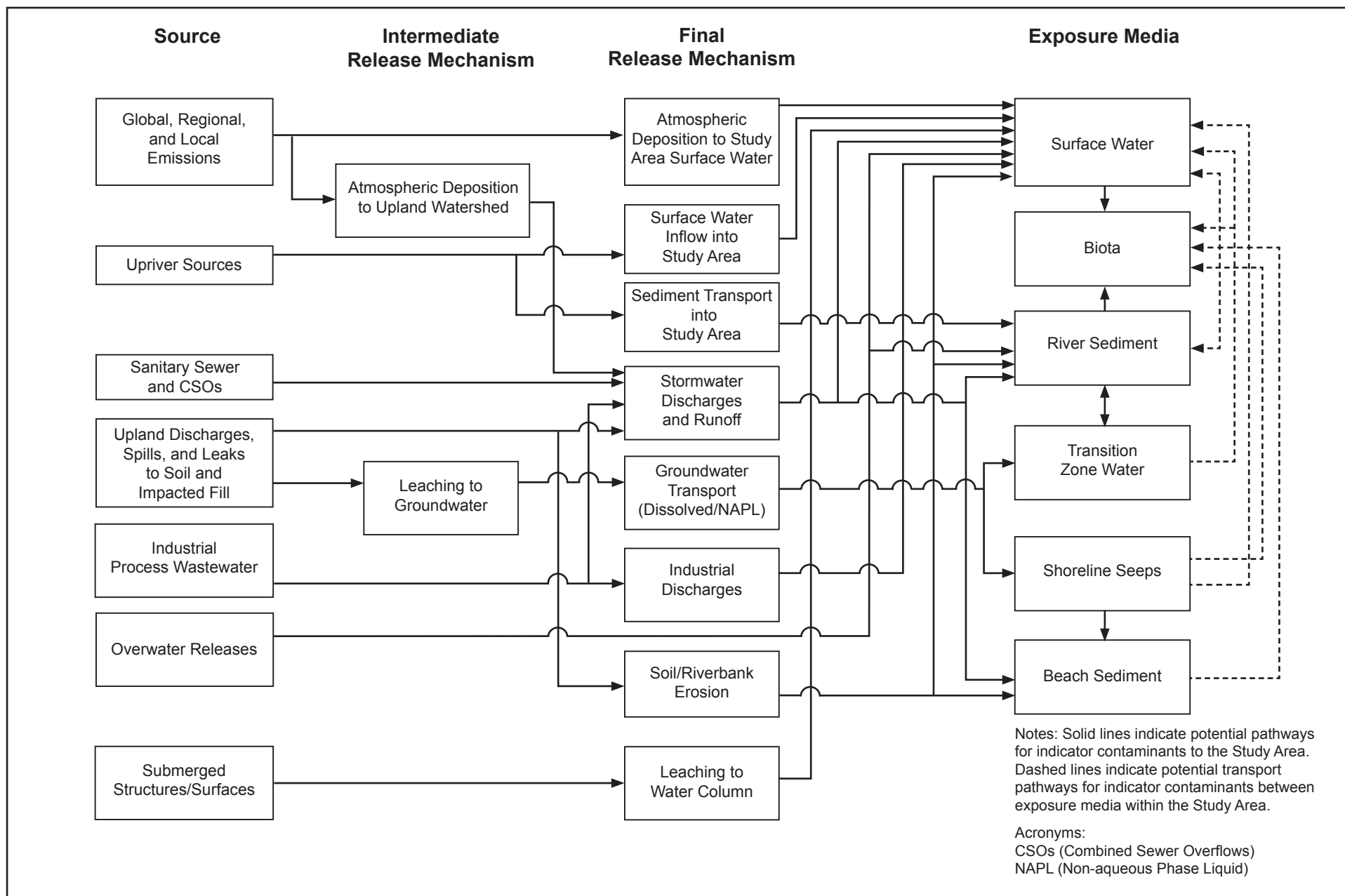
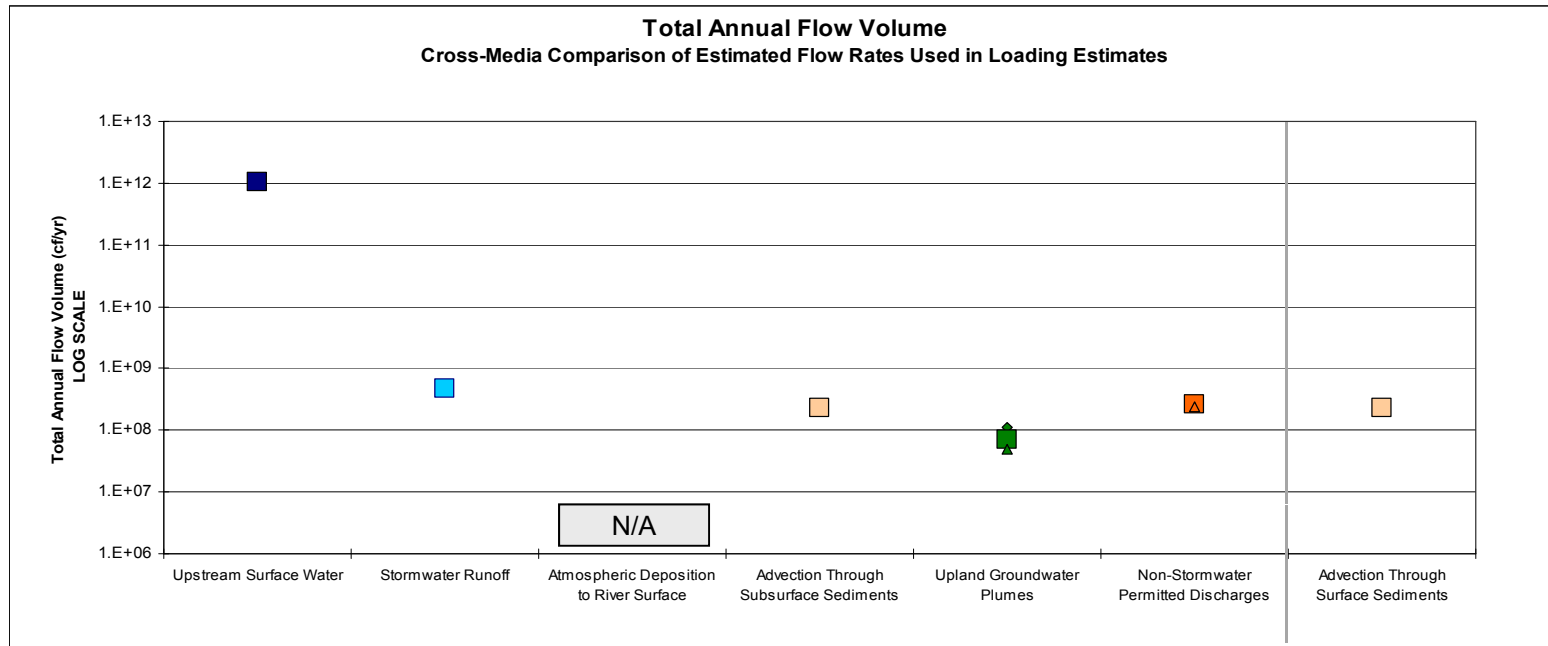


Figure 10.1-2
 Portland Harbor RI/FS
 Remedial Investigation Report
 Physical Conceptual Site Model



Legend

Upstream Surface Water Morrison Bridge (RM 12.8)

■ 28 yr average annual flow

Stormwater Runoff

■ Modeled 50th percentile flow year estimate

Advection through Sediments

■ Estimated central unit flux

Upland Groundwater Plume

◆ Maximum seepage measurement
■ Average seepage measurement
▲ Minimum seepage measurement

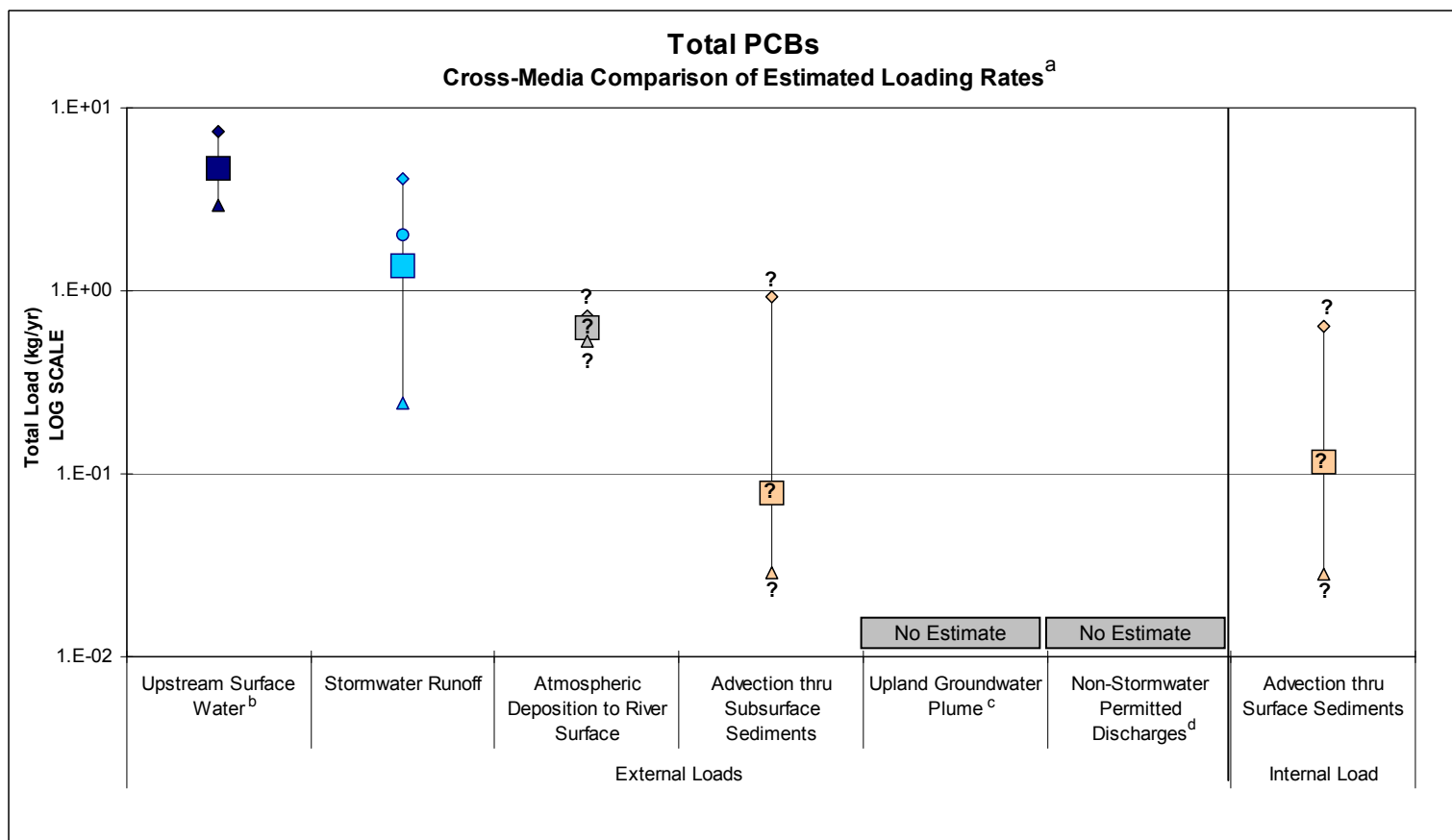
Non-Stormwater Permitted Discharges

◆ Maximum report discharge
■ Average reported discharge
▲ Minimum reported discharge

Notes

- Upstream surface water flow is based on the average annual flow measured at Morrison Bridge from 1975 to 2003.
- Stormwater runoff volumes shown are the sum of the modeled 50th percentile flows for each land use category and "non-representative" location.
- Upland groundwater plume flow rates represent the range of all flow measurements made with seepage meters at the nine TZW focus sites.
- The surface and subsurface sediment advective groundwater central unit flux rate of 7.3 cfs was estimated based on available site hydrogeologic information.
- Non-stormwater permitted discharge volumes presented here are the range of individual flow measurements reported monthly or quarterly in discharge monitoring reports for the most recent two years available for individual and general 1500A industrial permits.

Figure 10.1-3
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Comparison of Estimated Flow
Rates Used in Load Estimates



Legend

Upstream Surface Water (RM 11.8), Total

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Stormwater Runoff

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate
- Area-weighted central estimate

Atmospheric Deposition to River Surface

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Advection thru Sediments

- ◆ Upper estimate
- Primary estimate
- ▲ Lower estimate

Upland Groundwater Plume

- ◆ Unfiltered, central estimate
- Filtered, central estimate
- ▲ Filtered, lower estimate

Non-Stormwater Permitted Discharges

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

“?”

Indicates that the estimate is based on a combination of local data and non-local data/literature values.

“??”

Indicates that no local data were available for use in development of the estimate (based exclusively on non-local data/literature values).

Notes:

^a Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c The chemical was not identified as a COI for upland groundwater plumes with a known or likely complete pathway to the river; therefore, it was not included in the analyte list for TZW sampling. Consequently, no loading estimates were generated for upland plume loading for this chemical.

^d The chemical was not included for sampling on discharge permits (included permits defined in Section 6.1.3); therefore, there were no data to support loading calculations.

Figure 10.2-1a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Total PCBs – Estimated Total Annual Study Area Loads

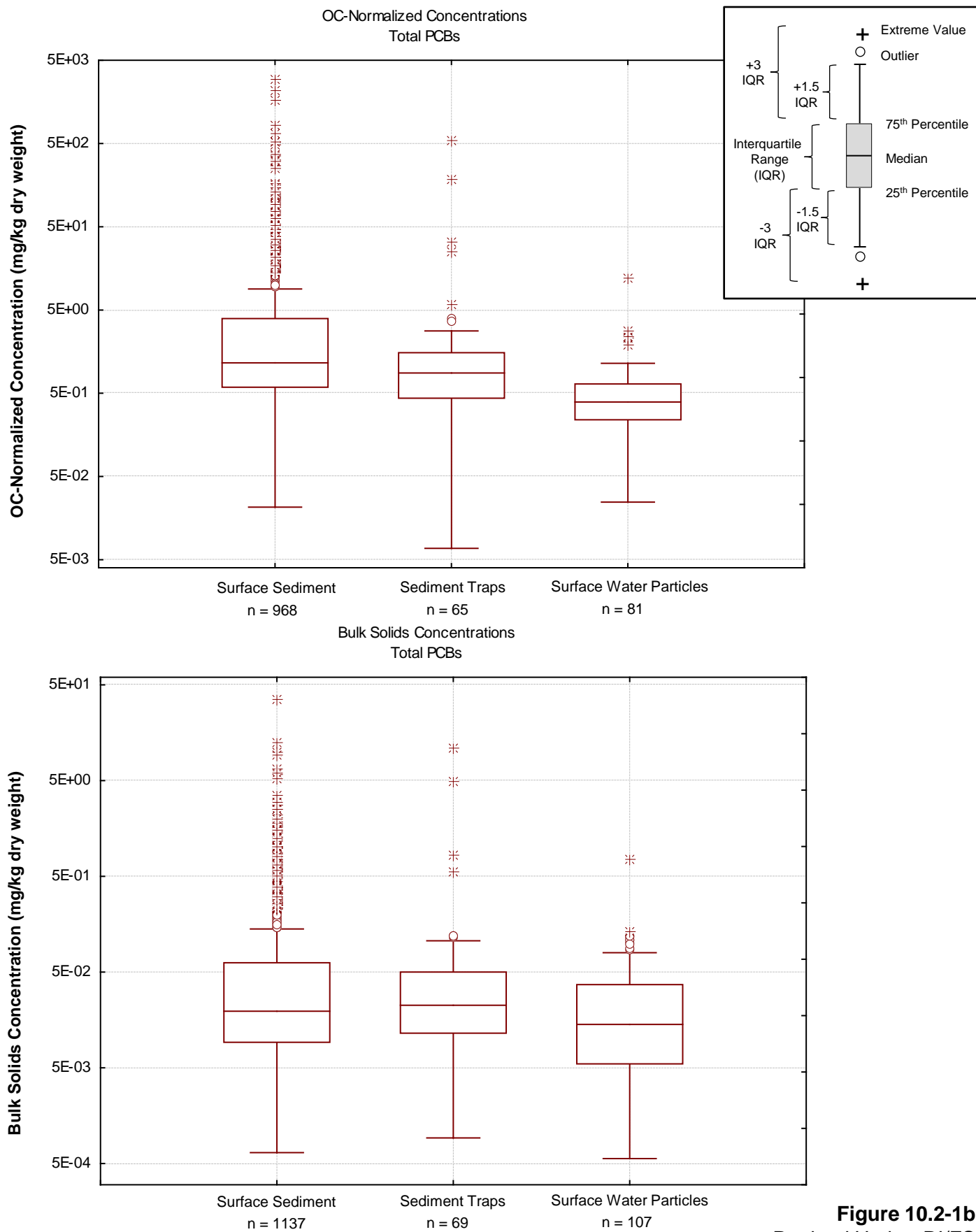
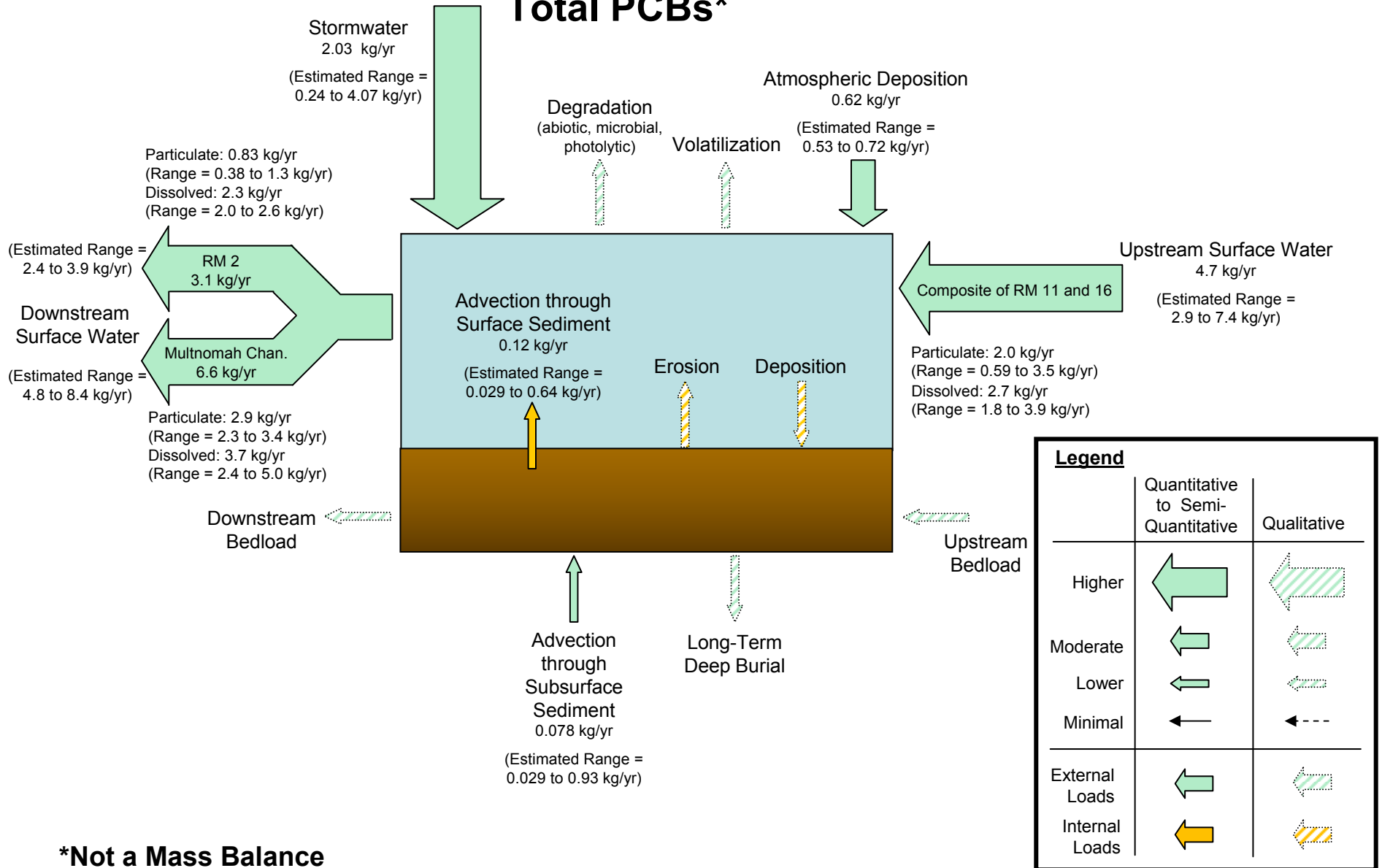


Figure 10.2-1b
Portland Harbor RI/FS
Remedial Investigation Report
Box-Whisker Plots of Total PCBs Bulk and
OC-Normalized Sediment, Sediment Trap,
and Particulate Surface Water Concentrations

Total PCBs*



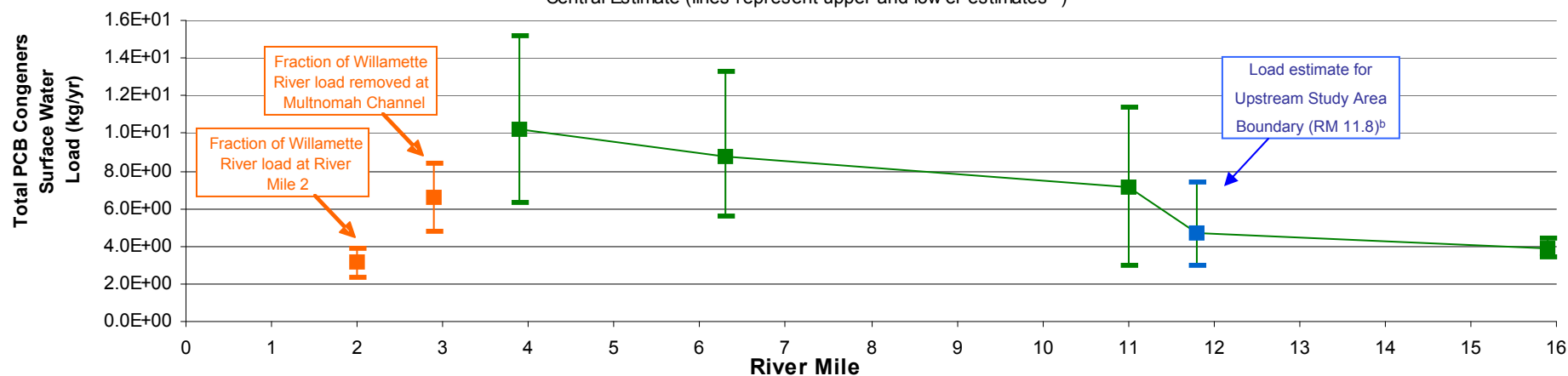
***Not a Mass Balance**

Figure 10.2-2
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
Total PCBs – Study Area Annual Central Loading Estimate

Total PCB Congeners

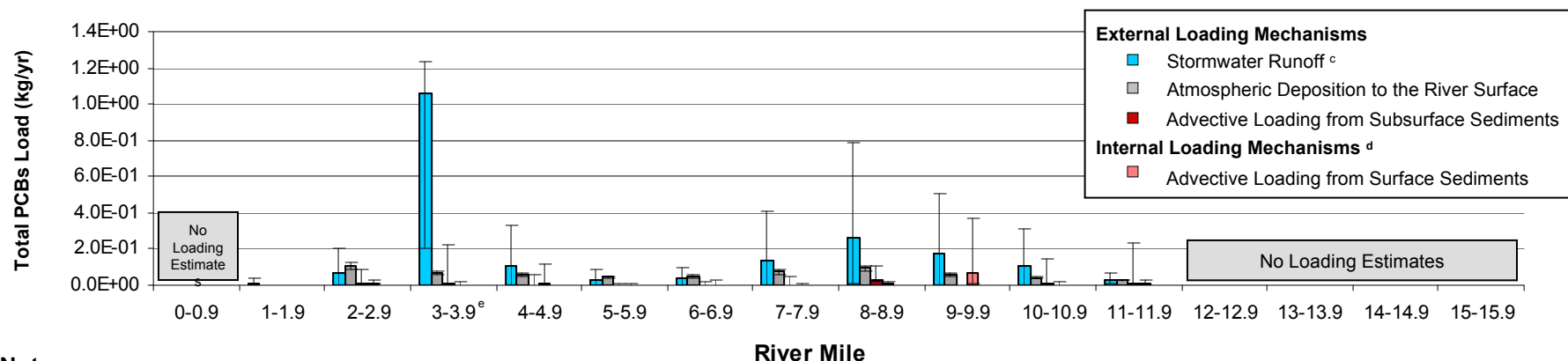
Estimated Total Annual Surface Water Load

Central Estimate (lines represent upper and lower estimates ^a)



Cross-Media Loading Comparison by River Mile

Central Estimate (lines represent upper and lower estimates^a)



Notes:

^a Upper and lower estimates were generated based on available data and do not necessarily reflect uncertainty in estimate. Refer to text (Sections 6.1 and 10.2) for discussions of uncertainty in these loading estimates.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c Stormwater estimates were generated for individual model cells rather than by river mile. Model cells frequently cross river mile boundaries; therefore, the river mile categories presented here are only approximations of stormwater runoff loading areas.

^d Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^e Load estimate includes one or more non-representative sites which may lead to increased uncertainty related to the stormwater sampling program and load calculation methods (see Section 6.1.2.2).

Figure 10.2-3
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Load and Loading Comparison by River Mile
Total PCBs

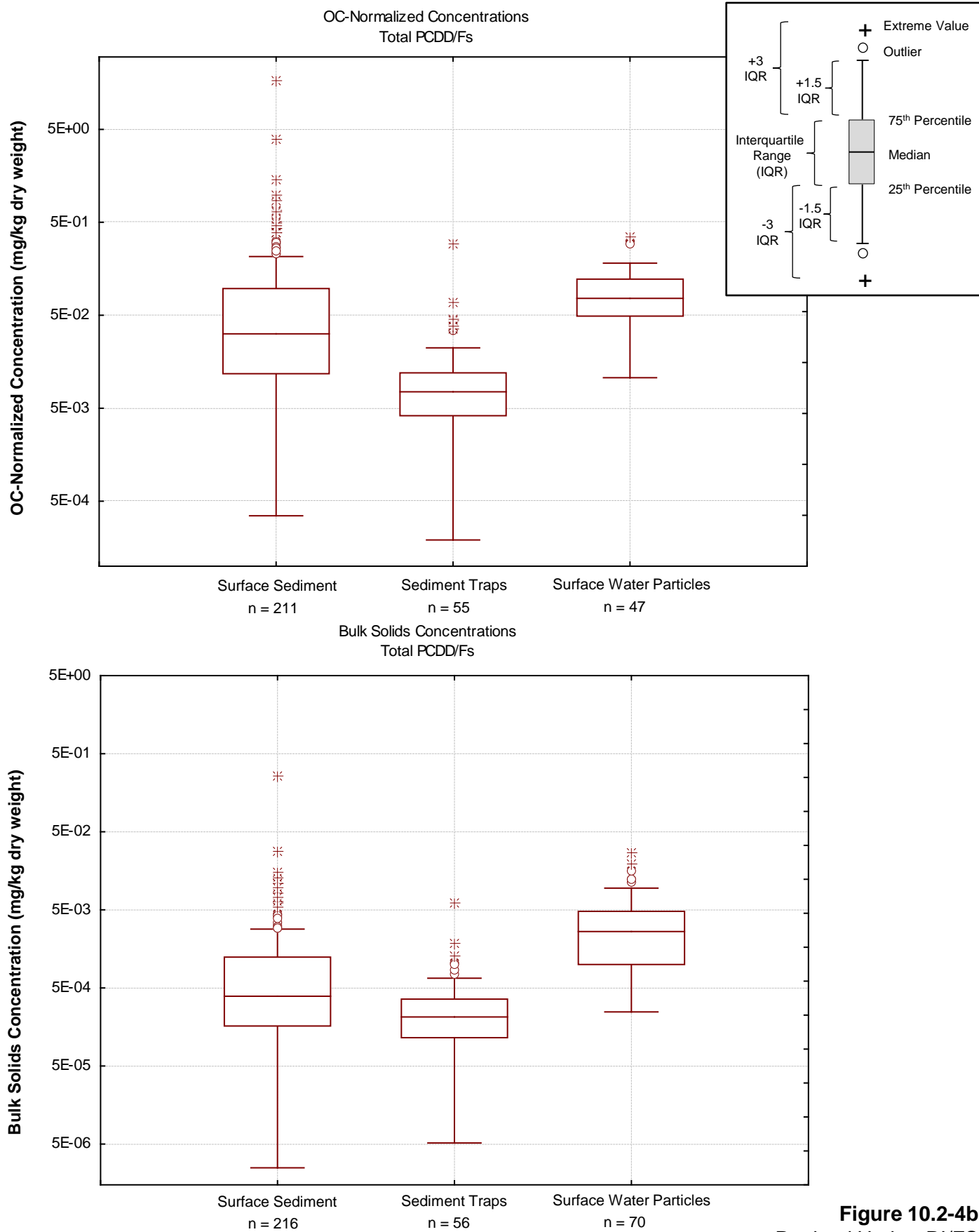


Figure 10.2-4b
Portland Harbor RI/FS
Remedial Investigation Report
Box-Whisker Plots of Total PCDD/Fs Bulk and
OC-Normalized Sediment, Sediment Trap,
and Particulate Surface Water Concentrations

Total PCDD/Fs*

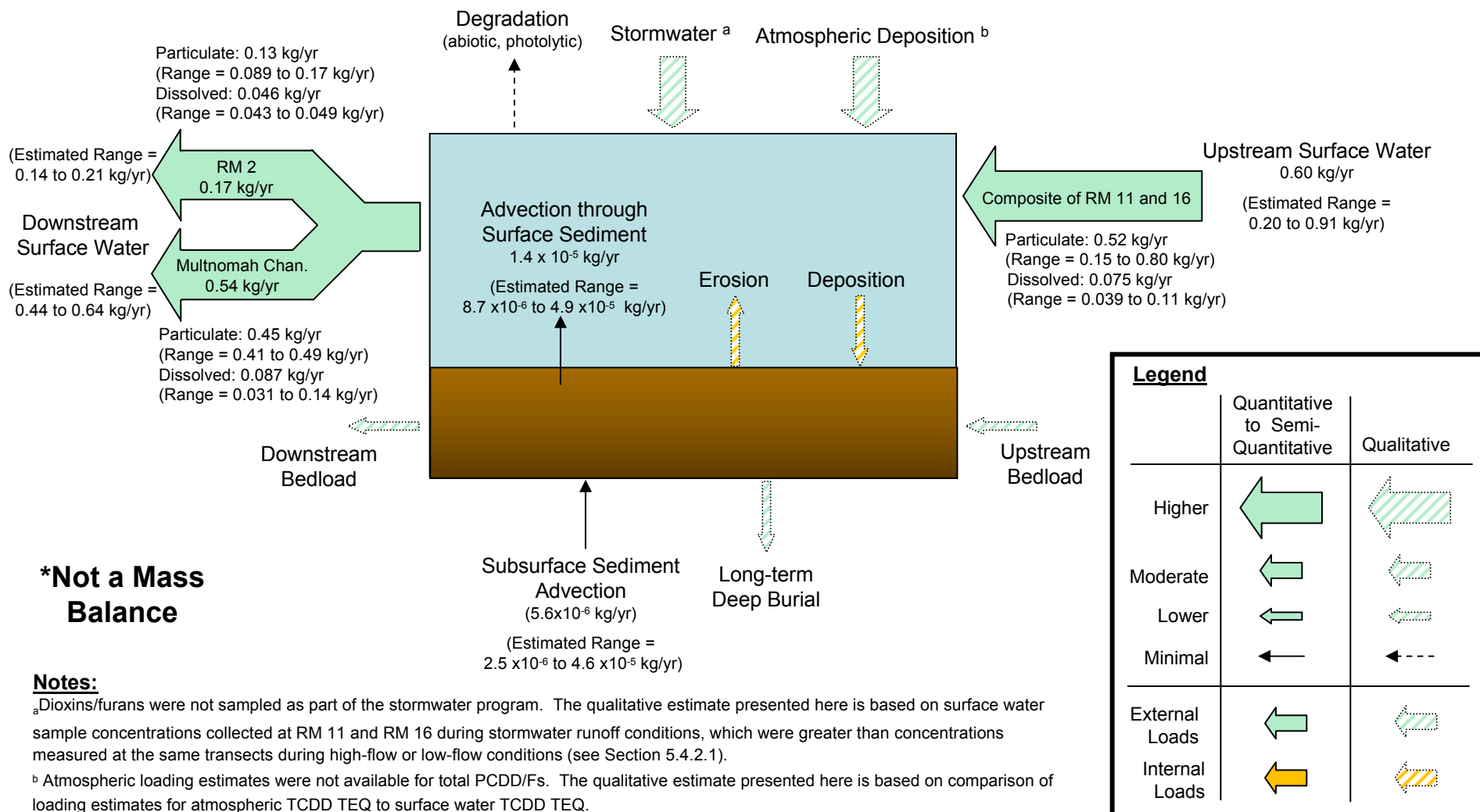
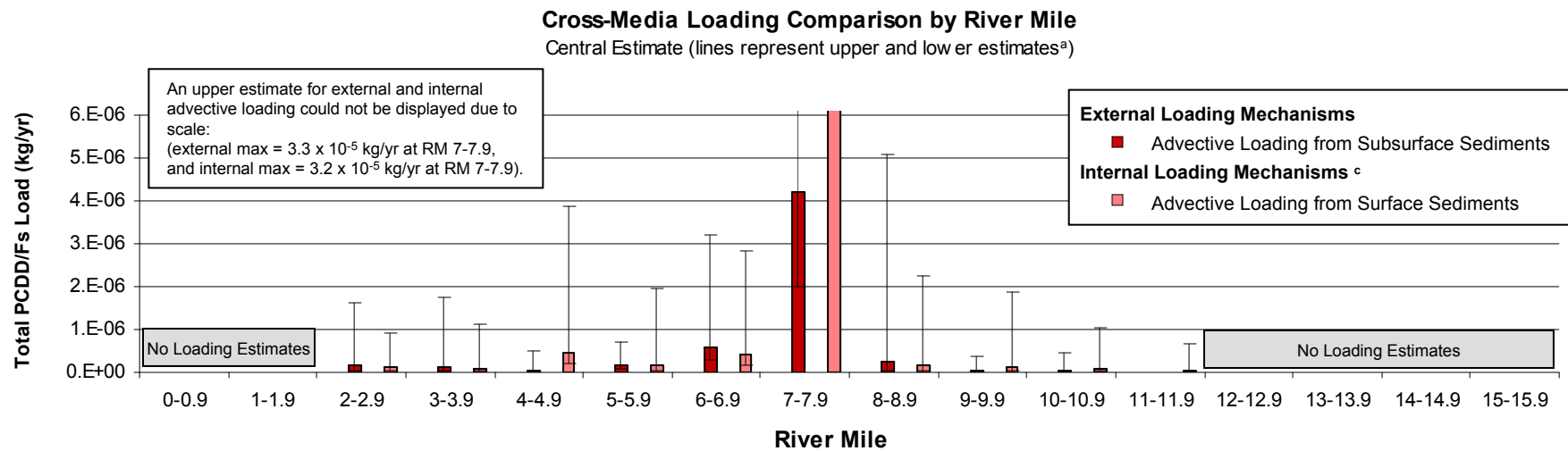
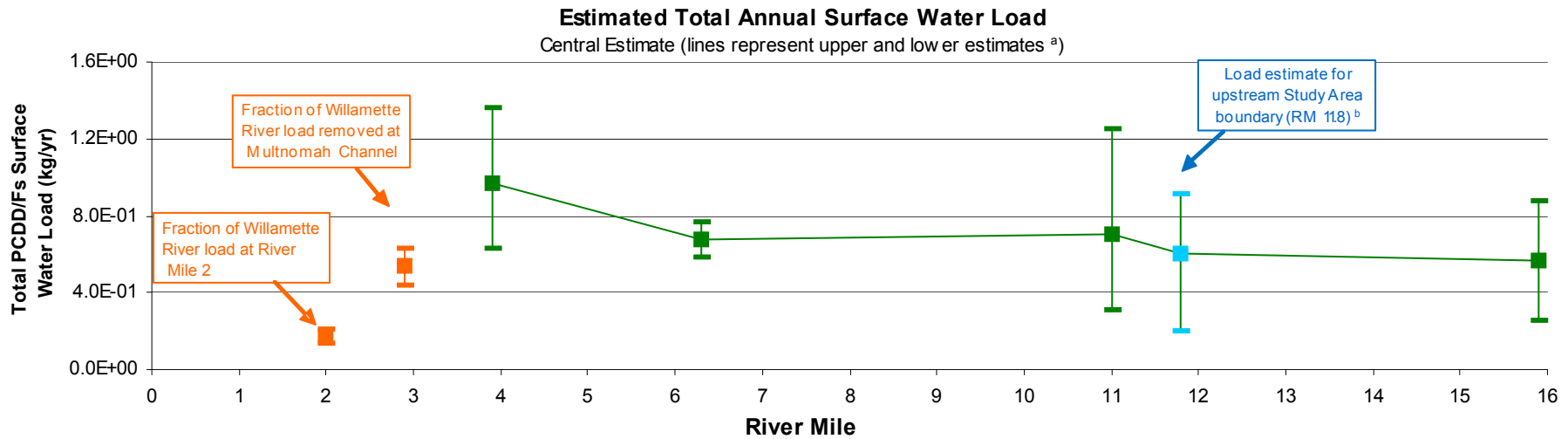


Figure 10.2-5
 Portland Harbor RI/FS
 Remedial Investigation Report
 Cross-Media Loading Box-Arrow Diagrams
 Total PCDD/Fs – Study Area Annual Central Loading Estimate

Total PCDD/Fs



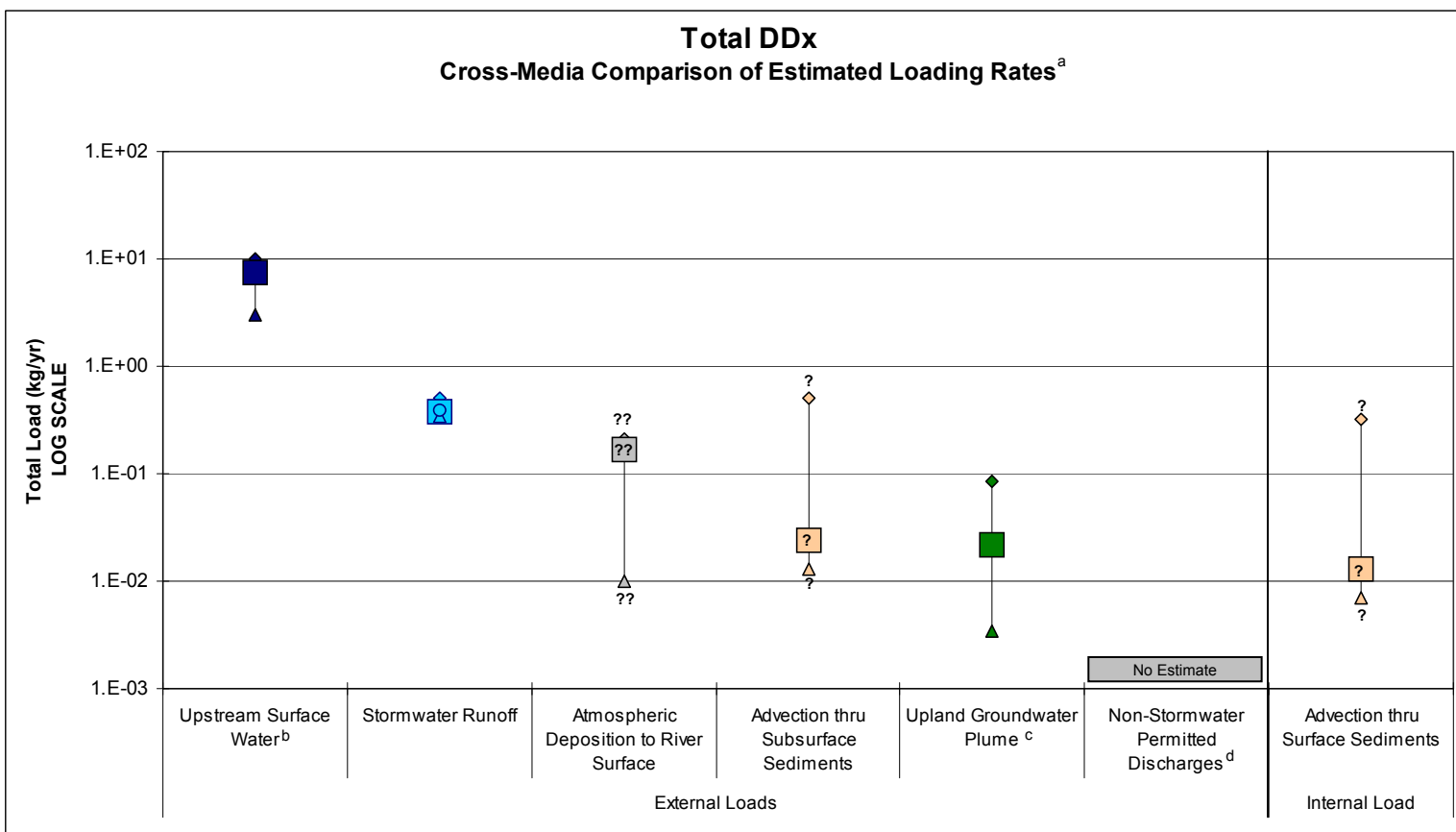
Notes:

^a Upper and lower estimates were generated based on available data and do not necessarily reflect uncertainty in estimate. Refer to text (Sections 6.1 and 10.2) for discussions of uncertainty in these loading estimates.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

Figure 10.2-6
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Load and Loading Comparison by River Mile
Total PCDD/Fs



Legend

Upstream Surface Water (RM 11.8), Total

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Stormwater Runoff

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate
- Area-weighted central estimate

Atmospheric Deposition to River Surface

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Advection thru Sediments

- ◆ Upper estimate
- Primary estimate
- ▲ Lower estimate

Upland Groundwater Plume

- ◆ Unfiltered, central estimate^e
- Filtered, central estimate
- ▲ Filtered, lower estimate

Non-Stormwater Permitted Discharges

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

- “?” Indicates that the estimate is based on a combination of local data and non-local data/literature values.
- “??” Indicates that no local data were available for use in development of the estimate (based exclusively on non-local data/literature values).

Notes:

^a Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c In areas where indicator contaminants in pore water are attributable to both upland groundwater plumes and in-river sediment sources (advective loading), the plume loading estimates (based on empirical measurements of pore water flows and concentrations) include the advective load also. Note that loading estimates for the fate and transport model will not include this redundancy.

^d The chemical was not included for sampling on discharge permits (included permits defined in Section 6.1.3); therefore, there were no data to support loading calculations.

^e Unfiltered pesticide results are likely biased high due to entrainment of sediments in the TZW samples.

Figure 10.2-7a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Total DDx – Estimated Total Annual Study Area Loads

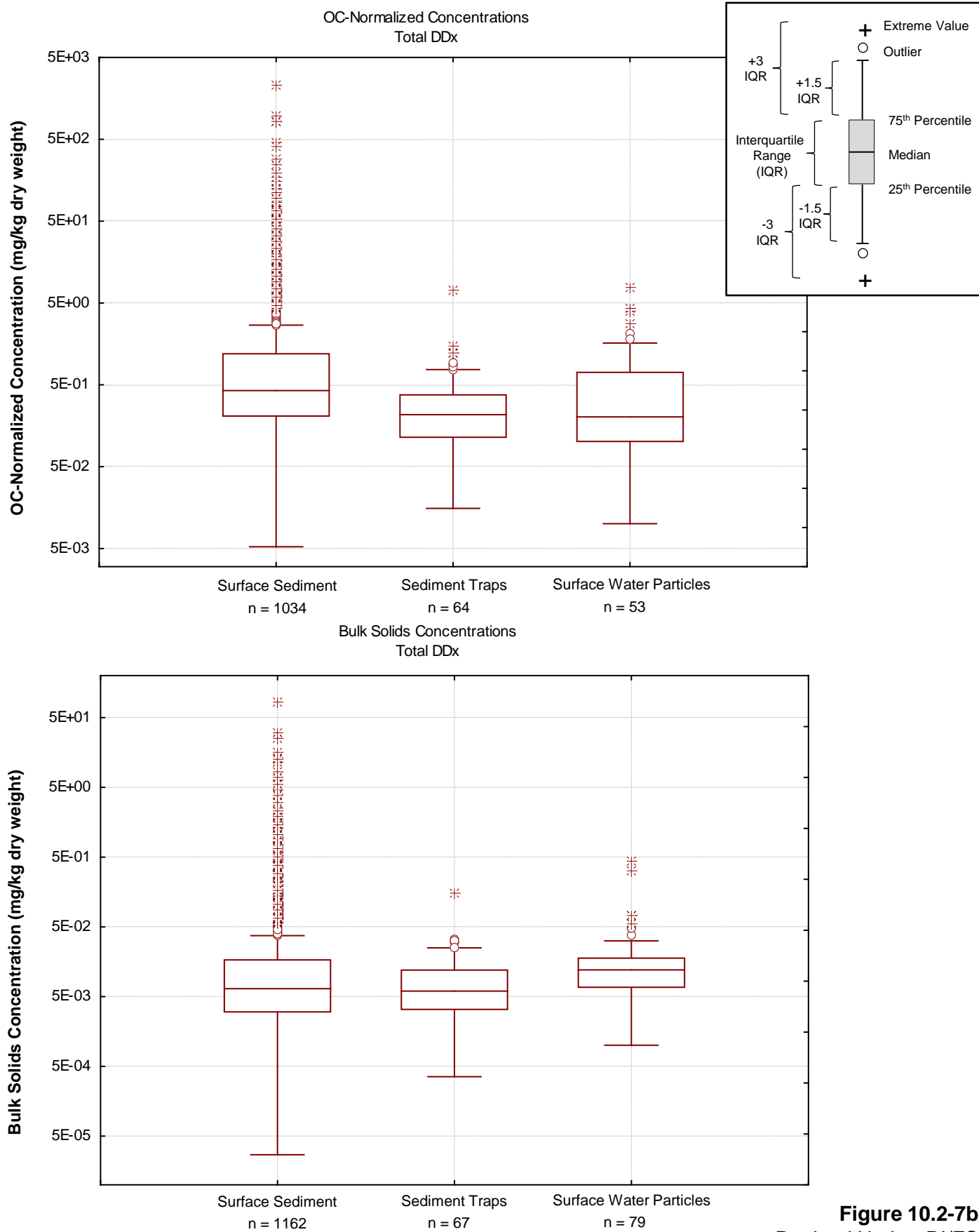
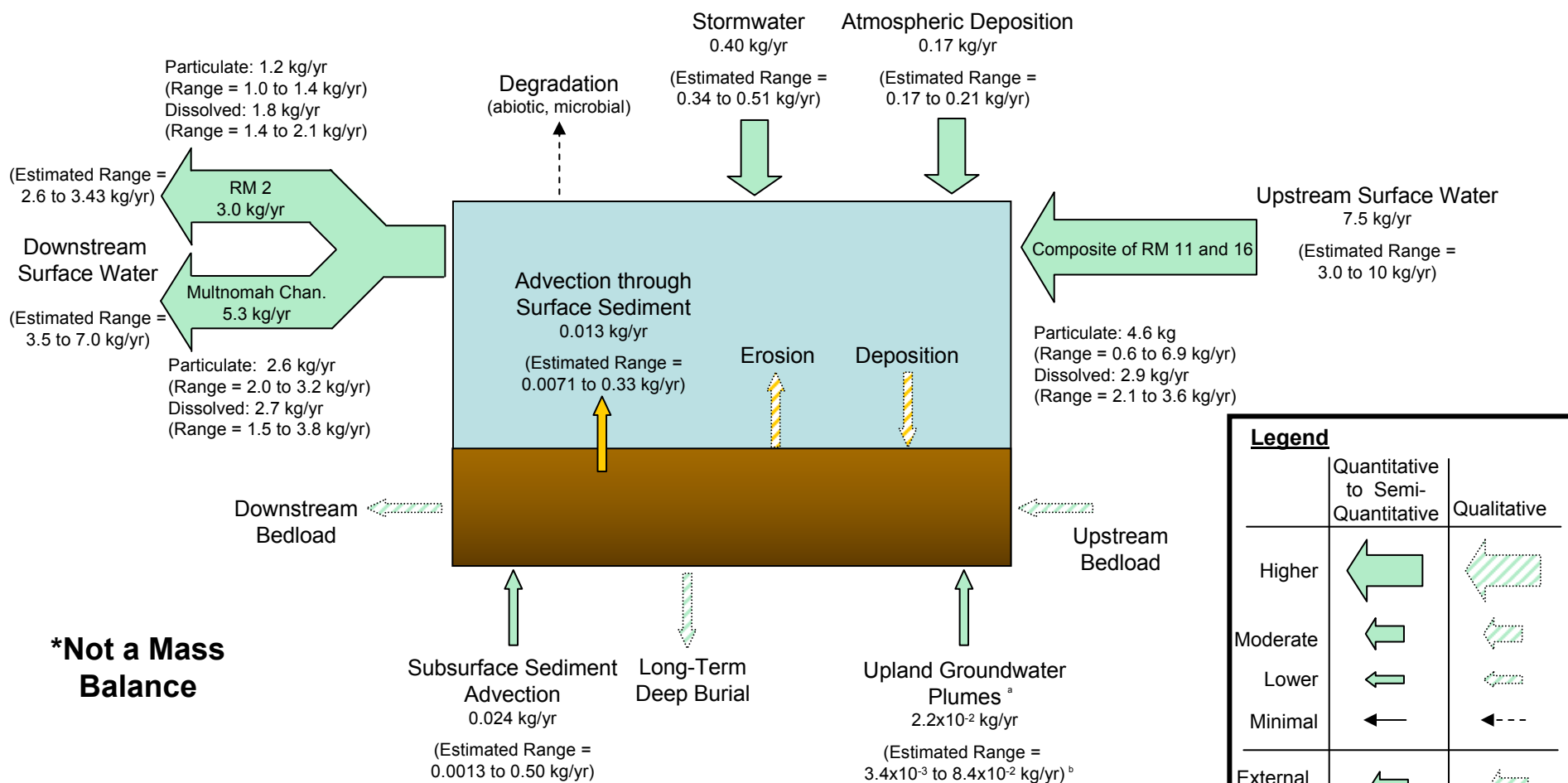


Figure 10.2-7b
Portland Harbor RI/FS
Remedial Investigation Report
Box-Whisker Plots of Total DDx Bulk and
OC-Normalized Sediment, Sediment Trap,
and Particulate Surface Water Concentrations

Total DDx*



***Not a Mass Balance**

Notes:

^a Note: In areas where indicator contaminants in pore water are attributable to both upland groundwater plumes and in-river sediment sources (advective loading), the plume loading estimates (based on empirical measurements of pore water flows and concentrations) include the advective load also. Note that loading estimates for the fate and transport model will not include this redundancy.

^b Unfiltered pesticide results (upper estimate) are likely biased high due to entrainment of sediments in the TZW samples.

	Legend	
	Quantitative to Semi-Quantitative	Qualitative
Higher		
Moderate		
Lower		
Minimal		
External Loads		
Internal Loads		

Figure 10.2-8
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
Total DDx – Study Area Annual Central Loading Estimate

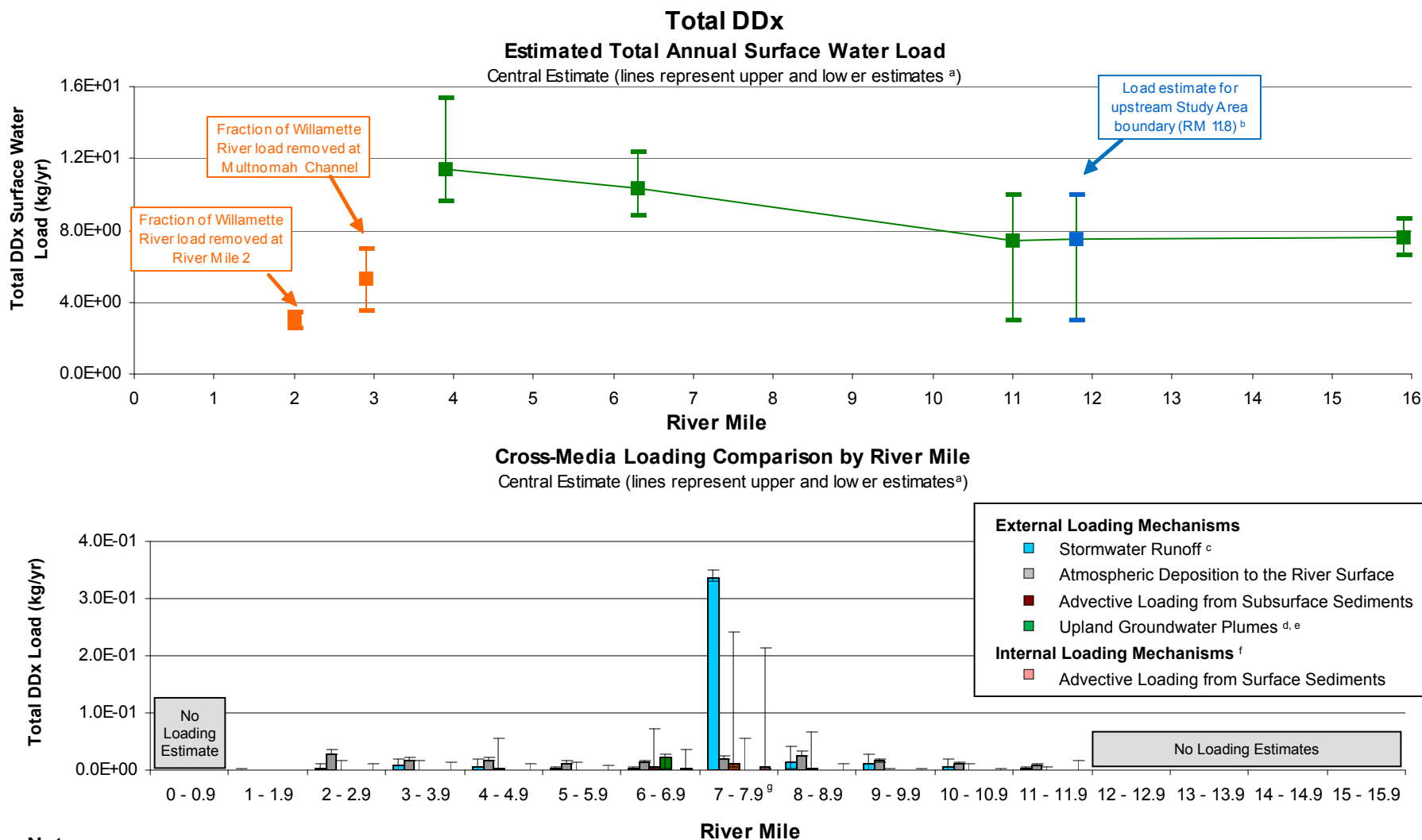


Figure 10.2-9
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Load and Loading Comparison by River Mile
Total DDx

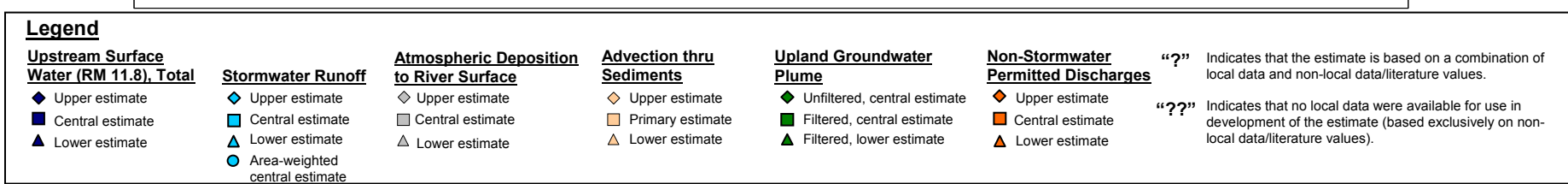


Figure 10.2-10a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Total PAHs – Estimated Total Annual Study Area Loads

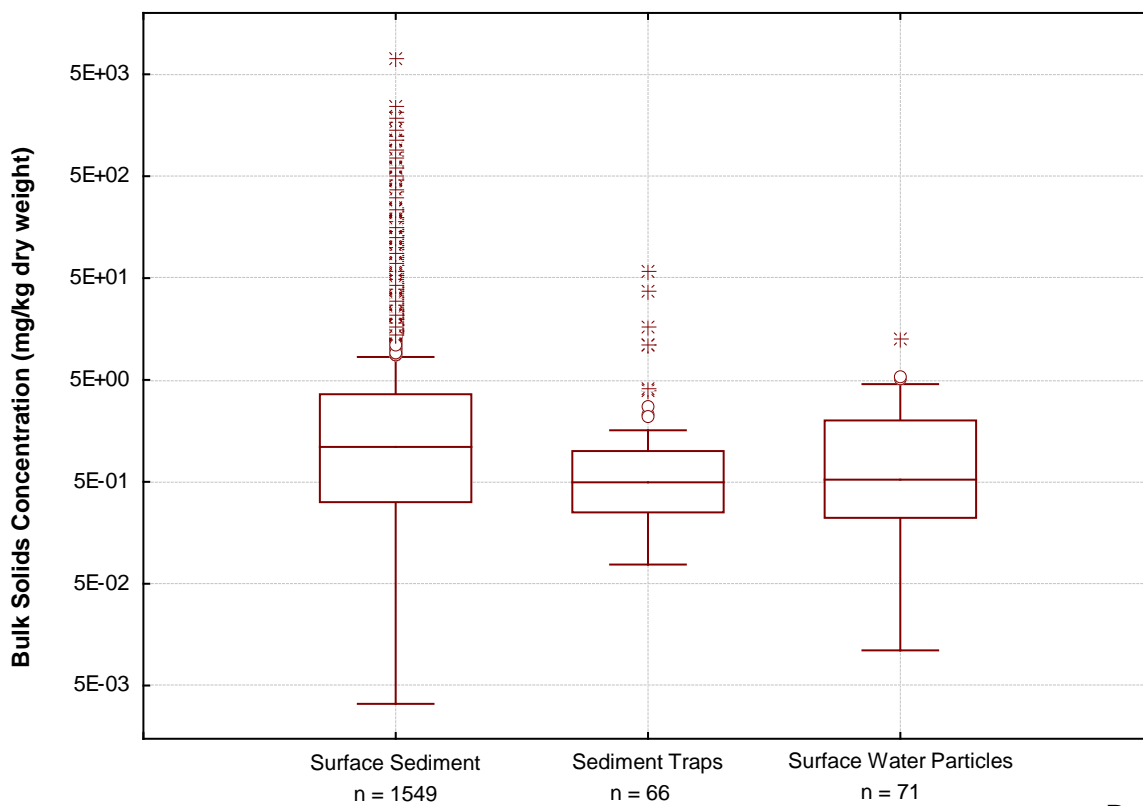
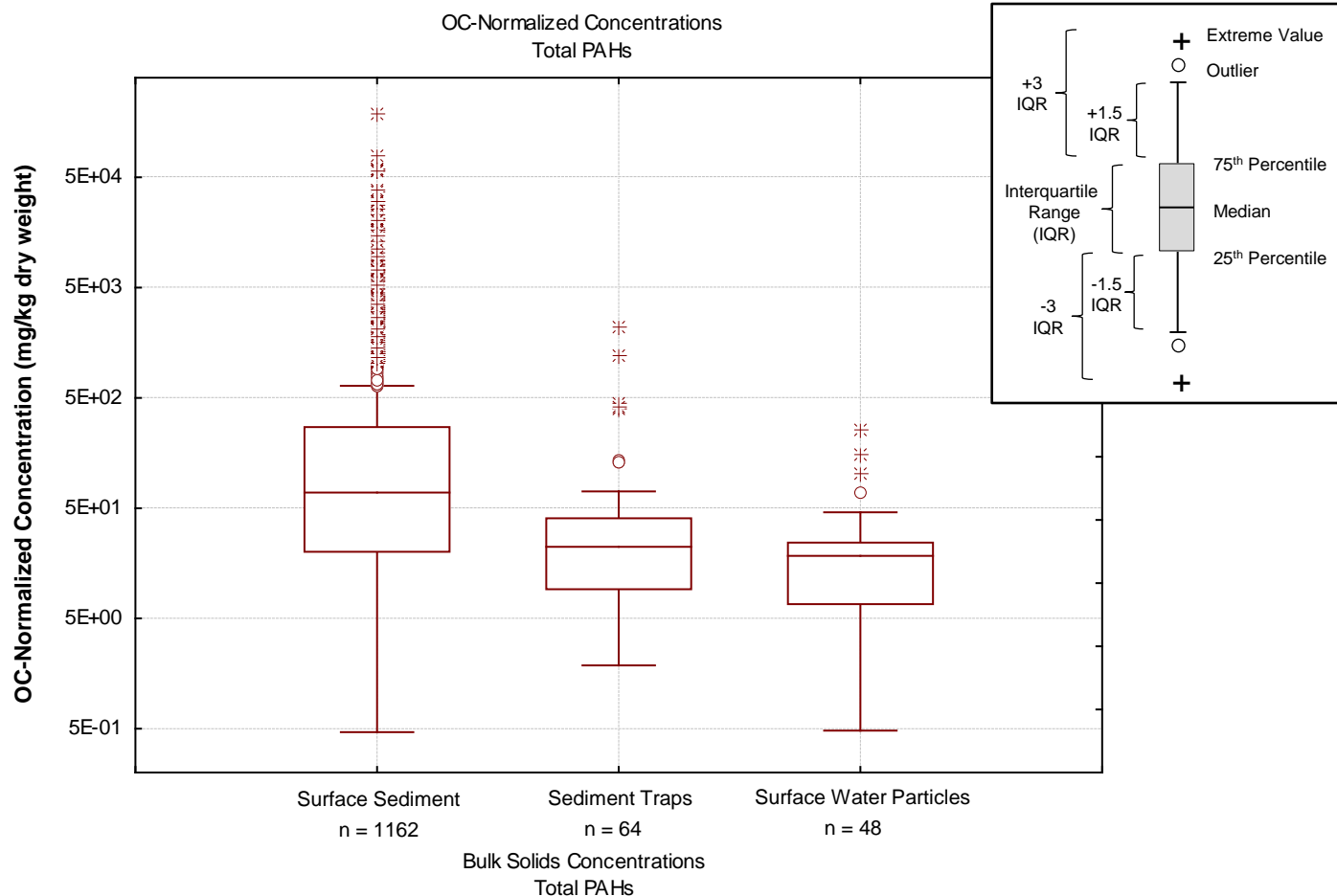


Figure 10.2-10b
 Portland Harbor RI/FS
 Remedial Investigation Report
 Box –Whisker Plots of Total PAHs Bulk and
 OC-Normalized Sediment, Sediment Trap,
 and Particulate Surface Water Concentrations

Total PAHs*

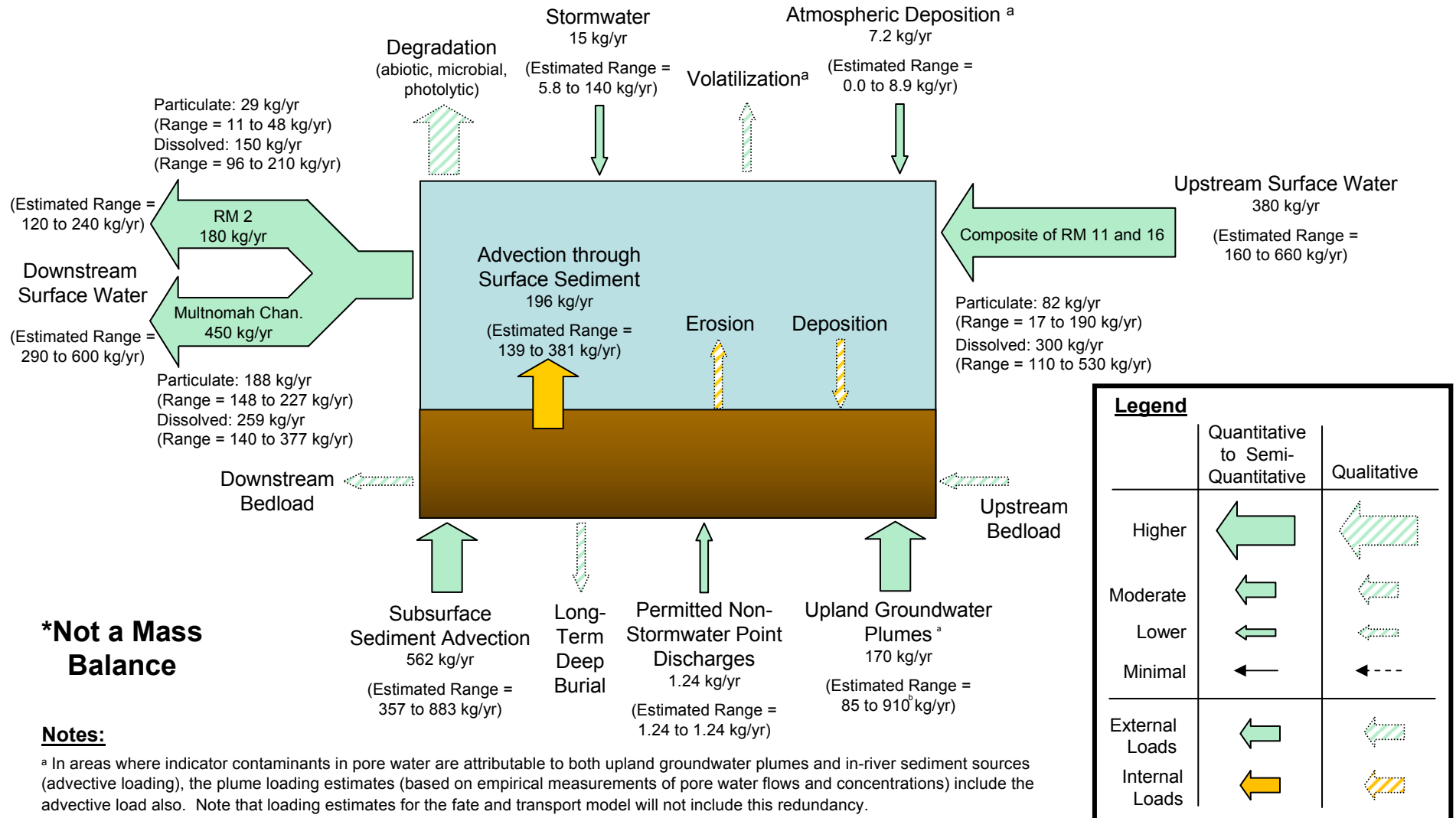


Figure 10.2-11a
 Portland Harbor RI/FS
 Remedial Investigation Report
 Cross-Media Loading Box-Arrow Diagrams
 Total PAHs – Study Area Annual Central Loading Estimate

LPAHs*

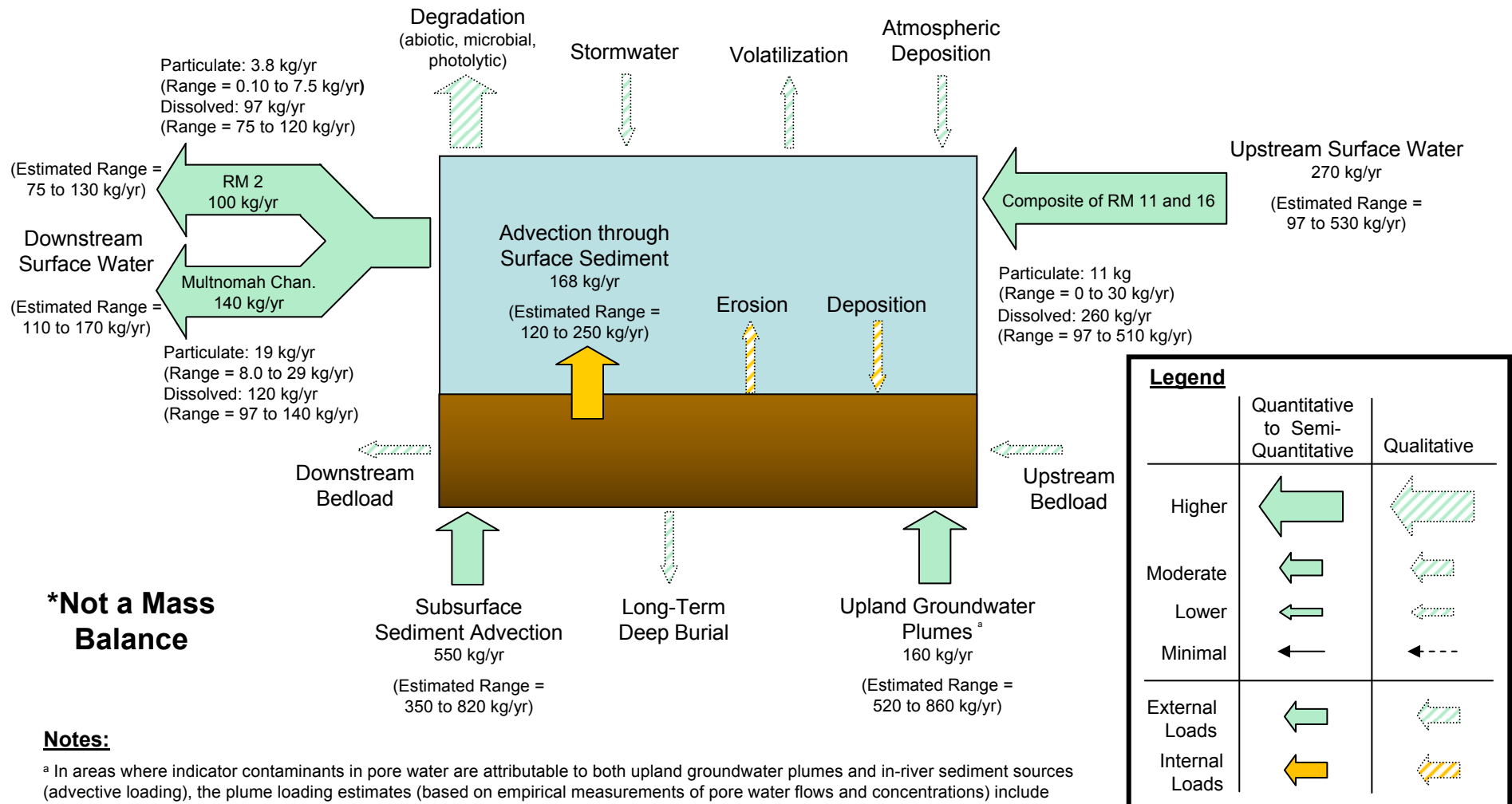


Figure 10.2-11b
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
LPAHs – Study Area Annual Central Loading Estimate

HPAHs*

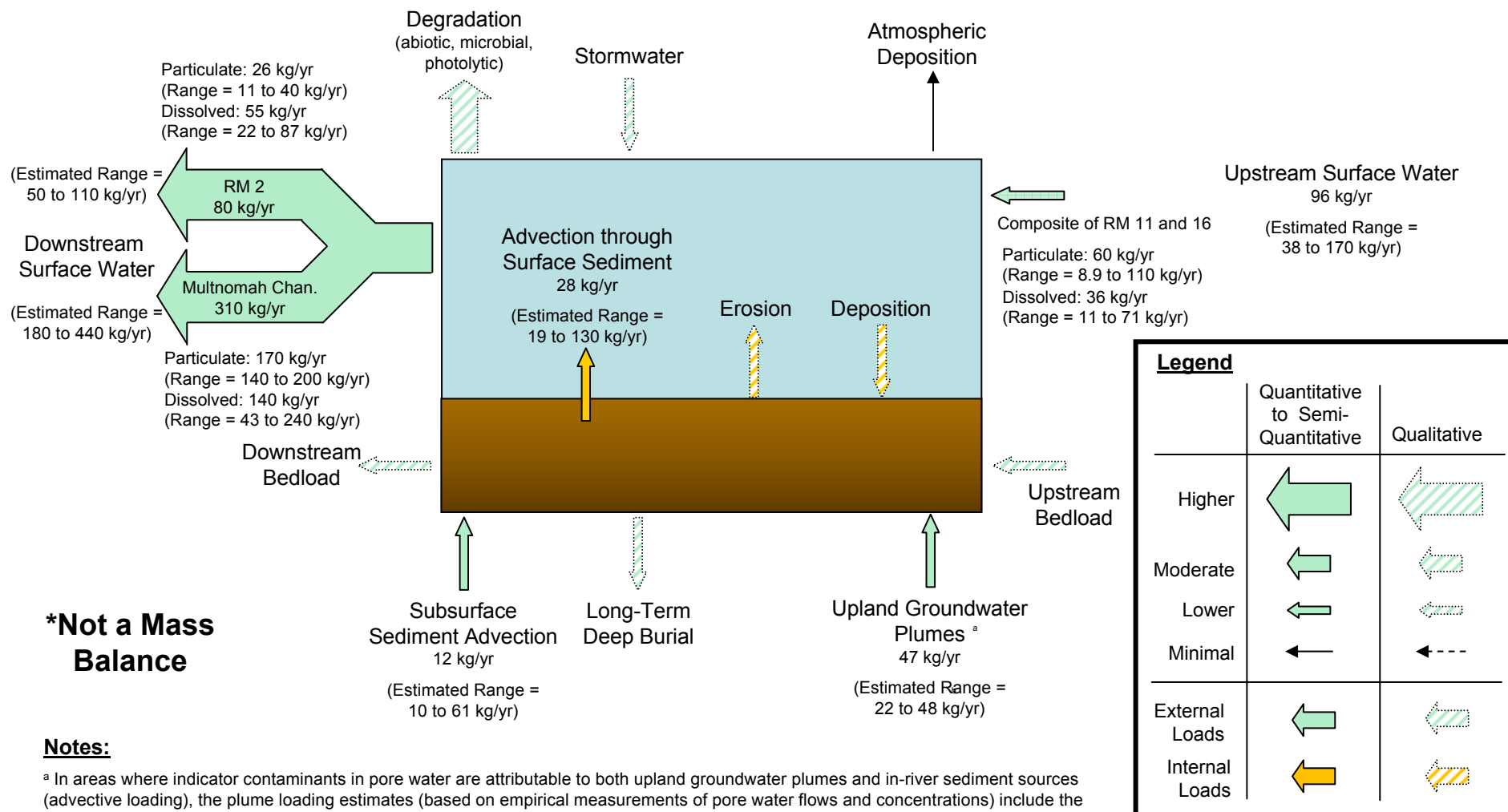
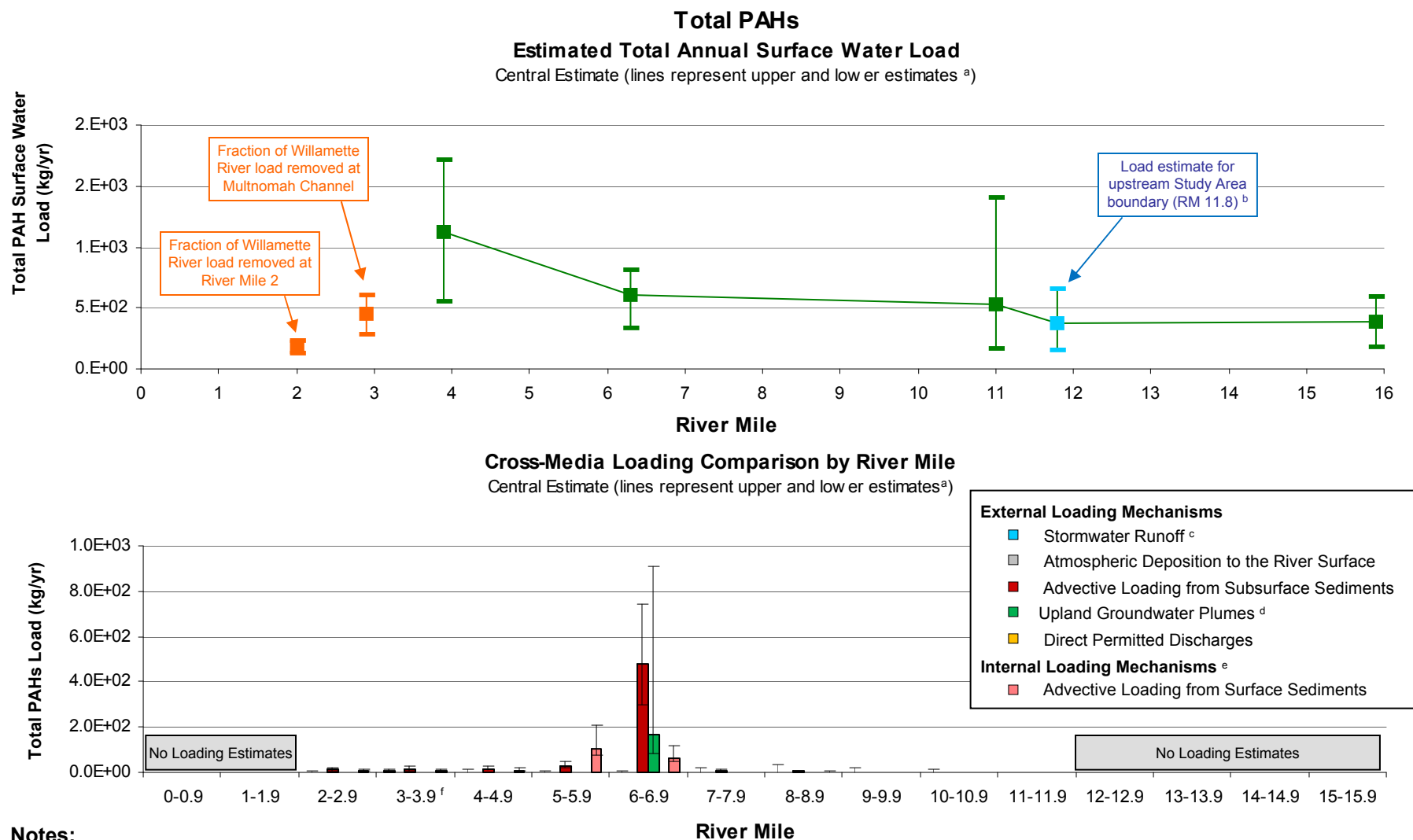


Figure 10.2-11c
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
HPAHs – Study Area Annual Central Loading Estimate



Notes:

^a Upper and lower estimates were generated based on available data and do not necessarily reflect uncertainty in estimate. Refer to text (Sections 6.1 and 10.2) for discussions of uncertainty in these loading estimates.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

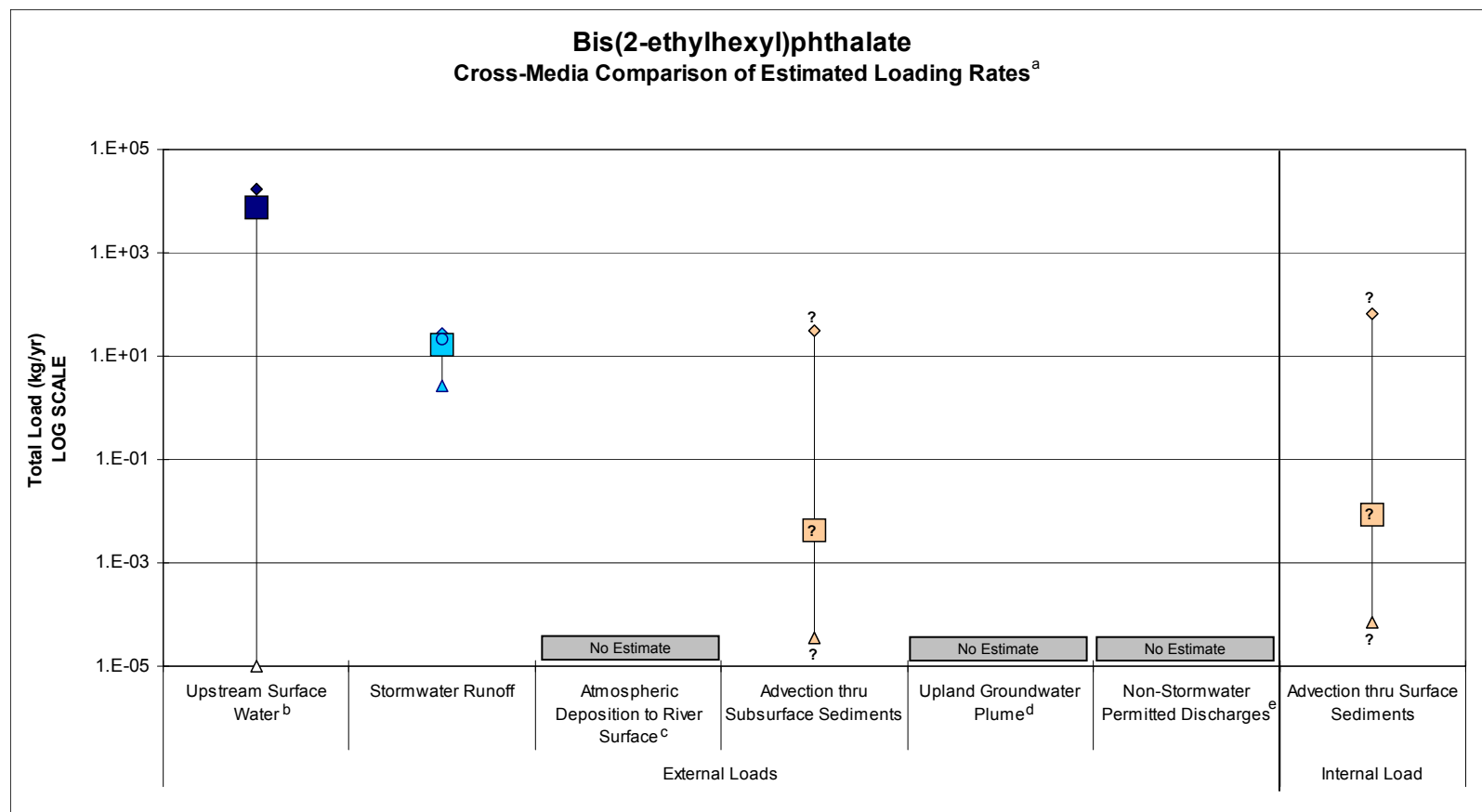
^c Stormwater estimates were generated for individual model cells rather than by river mile. Model cells frequently cross river mile boundaries; therefore, the river mile categories presented here are only approximations of stormwater runoff loading areas.

^d In areas where indicator contaminants in pore water are attributable to both upland groundwater plumes and in-river sediment sources (advective loading), the plume loading estimates (based on empirical measurements of pore water flows and concentrations) include the advective load also. Note that loading estimates for the fate and transport model will not include this redundancy.

^e Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^f Load estimate includes one or more non-representative sites which may lead to increased uncertainty related to the stormwater sampling program and load calculation methods (see Section 6.1.2.2).

Figure 10.2-12
 Portland Harbor RI/FS
 Remedial Investigation Report
 Surface Water Load and Loading Comparison by River Mile
 Total PAHs



Legend

Upstream Surface Water (RM 11.8), Total

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Stormwater Runoff

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate
- Area-weighted central estimate

Atmospheric Deposition to River Surface

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Advection thru Sediments

- ◆ Upper estimate
- Primary estimate
- ▲ Lower estimate

Upland Groundwater Plume

- ◆ Unfiltered, central estimate
- Filtered, central estimate
- ▲ Filtered, lower estimate

Non-Stormwater Permitted Discharges

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

“?” Indicates that the estimate is based on a combination of local data and non-local data/literature values.

“??” Indicates that no local data were available for use in development of the estimate (based exclusively on non-local data/literature values).

Notes:

Hollow symbols indicate loads calculated with sample concentrations below the laboratory detection limit. These loads were estimated at 0 kg/yr.

^a Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c No relevant atmospheric concentration data were found for this chemical; therefore, no loading estimates could be generated.

^d The chemical was not identified as a COI for upland groundwater plumes with a known or likely complete pathway to the river; therefore, it was not included in the analyte list for TZW sampling. Consequently, no loading estimates were generated for upland plume loading for this chemical.

^e The chemical was not included for sampling on discharge permits (included permits defined in Section 6.1.3); therefore, there were no data to support loading calculations.

Figure 10.2-13a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Bis(2-ethylhexyl)phthalate – Estimated Total Annual Study Area Loads

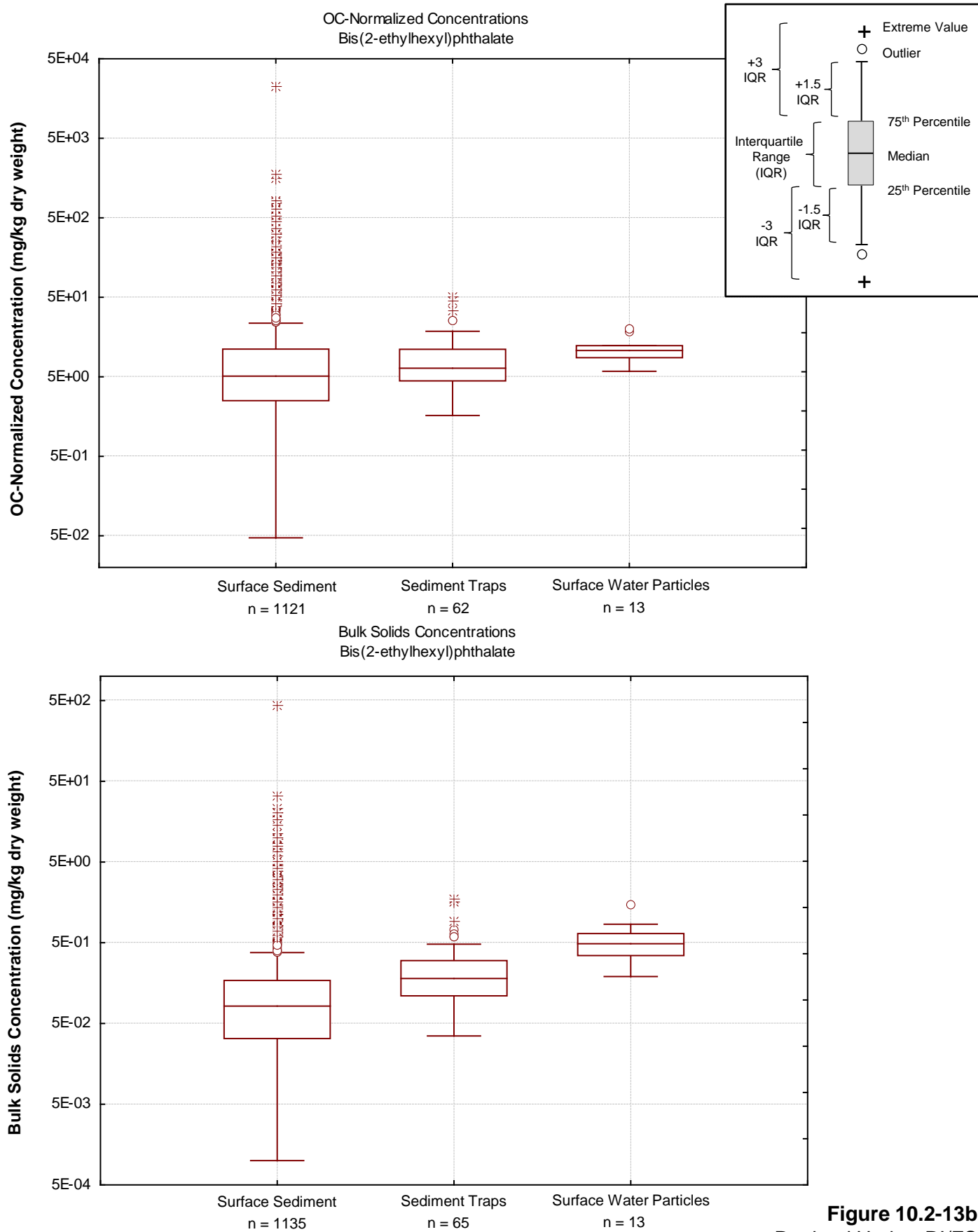
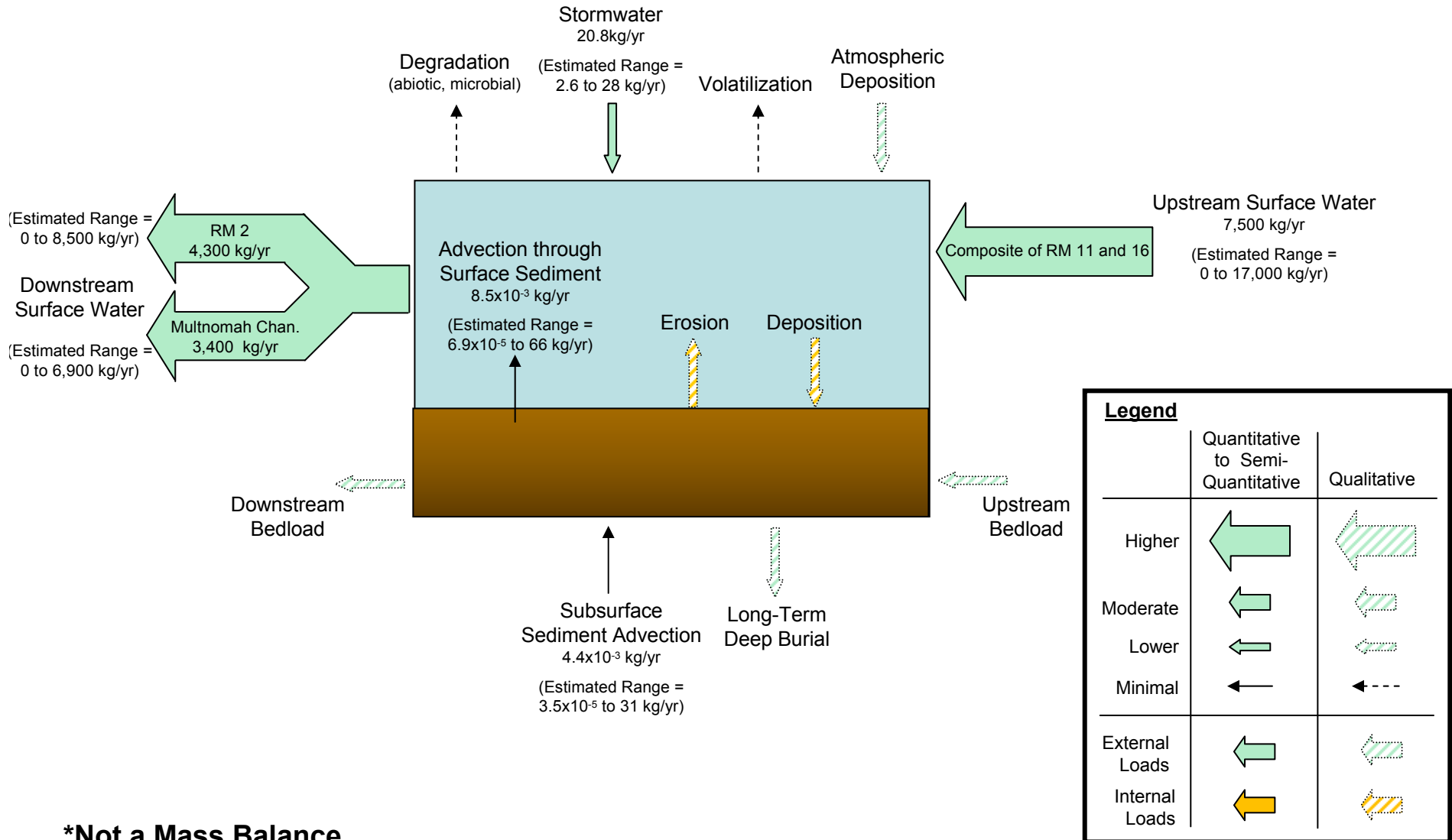


Figure 10.2-13b
Portland Harbor RI/FS
Remedial Investigation Report
Box-Whisker Plots of Bis(2-ethylhexyl)phthalate Bulk and
OC-Normalized Sediment, Sediment Trap,
and Particulate Surface Water Concentrations

Bis(2-ethylhexyl)phthalate*



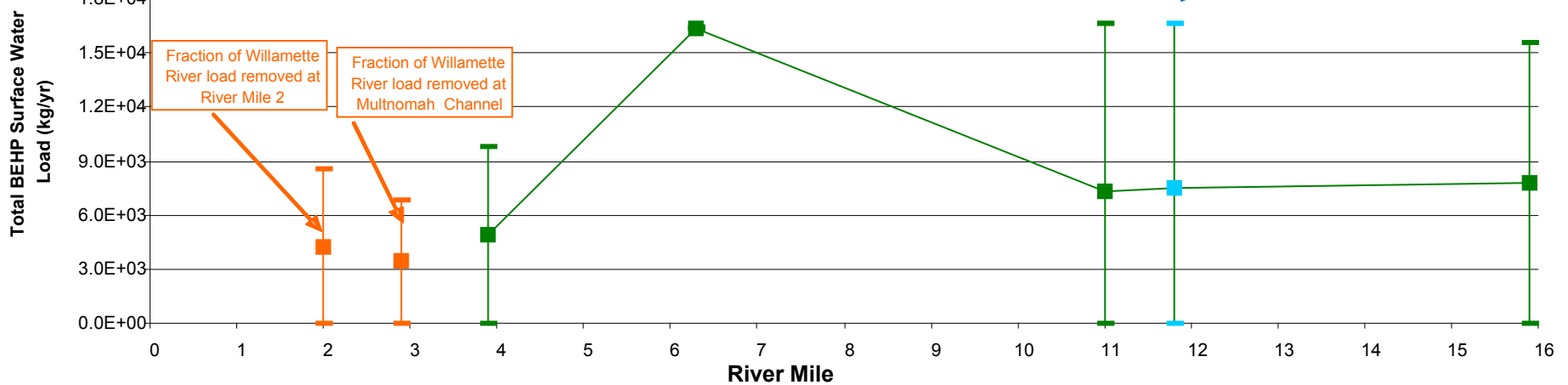
***Not a Mass Balance**

Figure 10.2-14
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
Bis(2-ethylhexyl)phthalate – Study Area Annual Central Loading Estimate

Bis(2-ethylhexyl)phthalate

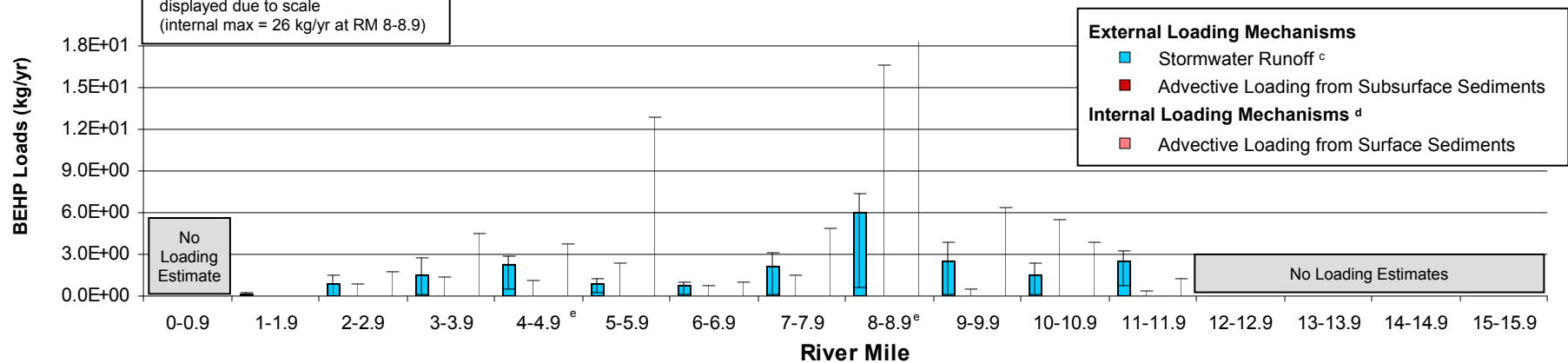
Estimated Total Annual Surface Water Load

Central Estimate (lines represent upper and lower estimates ^a)



Cross-Media Loading Comparison by River Mile

Central Estimate (lines represent upper and lower estimates^a)



Notes:

^a Upper and lower estimates were generated based on available data and do not necessarily reflect uncertainty in estimate. Refer to text (Sections 6.1 and 10.2) for discussions of uncertainty in these loading estimates.

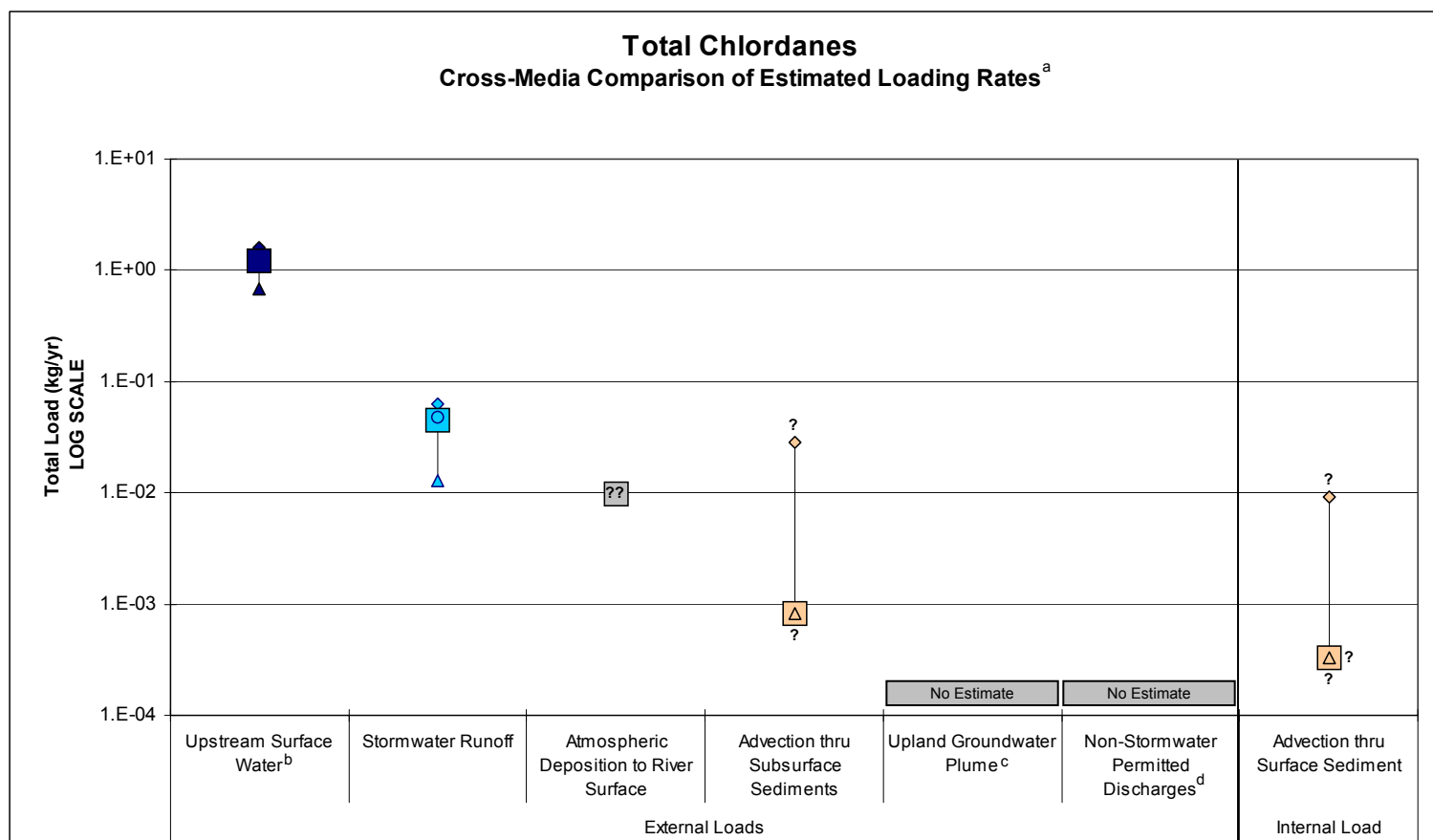
^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c Stormwater estimates were generated for individual model cells rather than by river mile. Model cells frequently cross river mile boundaries; therefore, the river mile categories presented here are only approximations of stormwater runoff loading areas.

^d Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^e Load estimate includes one or more non-representative sites which may lead to increased uncertainty related to the stormwater sampling program and load calculation methods (see Section 6.1.2.2).

Figure 10.2-15
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Load and Loading Comparison by River Mile
Bis(2-ethylhexyl)phthalate



Legend

Upstream Surface Water (RM 11.8), Total

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Stormwater Runoff

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate
- Area-weighted central estimate

Atmospheric Deposition to River Surface

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Advection thru Subsurface Sediments

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Upland Groundwater Plume

- ◆ Unfiltered, central estimate
- Filtered, central estimate
- ▲ Filtered, lower estimate

Non-Stormwater Permitted Discharges

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

“?”

Indicates that the estimate is based on a combination of local data and non-local data/literature values.

“??”

Indicates that no local data were available for use in development of the estimate (based exclusively on non-local data/literature values).

Notes:

^a Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c The chemical was not identified as a COI for upland groundwater plumes with a known or likely complete pathway to the river; therefore, it was not included in the analyte list for TZW sampling. Consequently, no loading estimates were generated for upland plume loading for this chemical.

^d The chemical was not included for sampling on discharge permits (included permits defined in Section 6.1.3); therefore, there were no data to support loading calculations.

Figure 10.2-16a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Total Chlordanes – Estimated Total Annual Study Area Loads

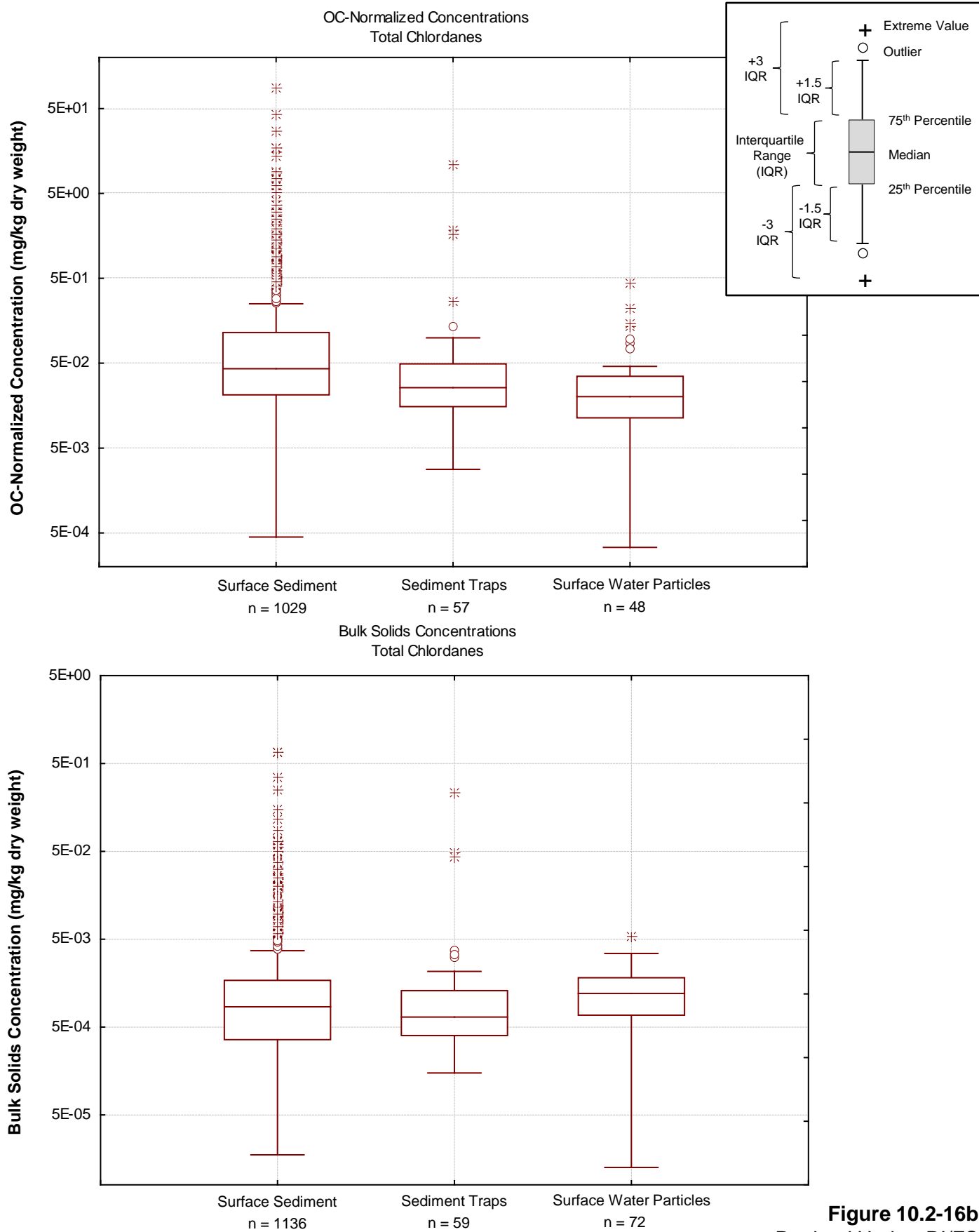
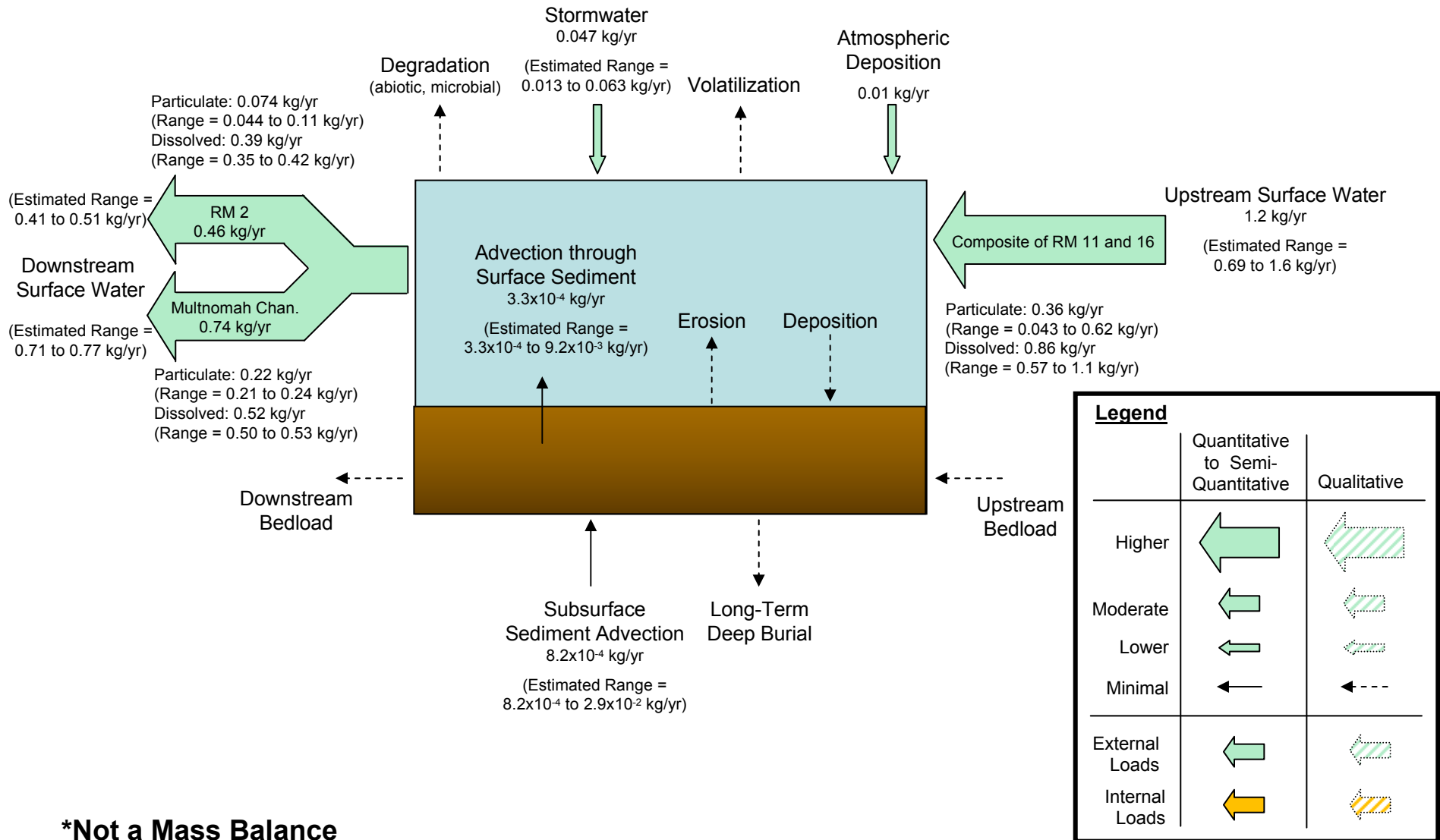


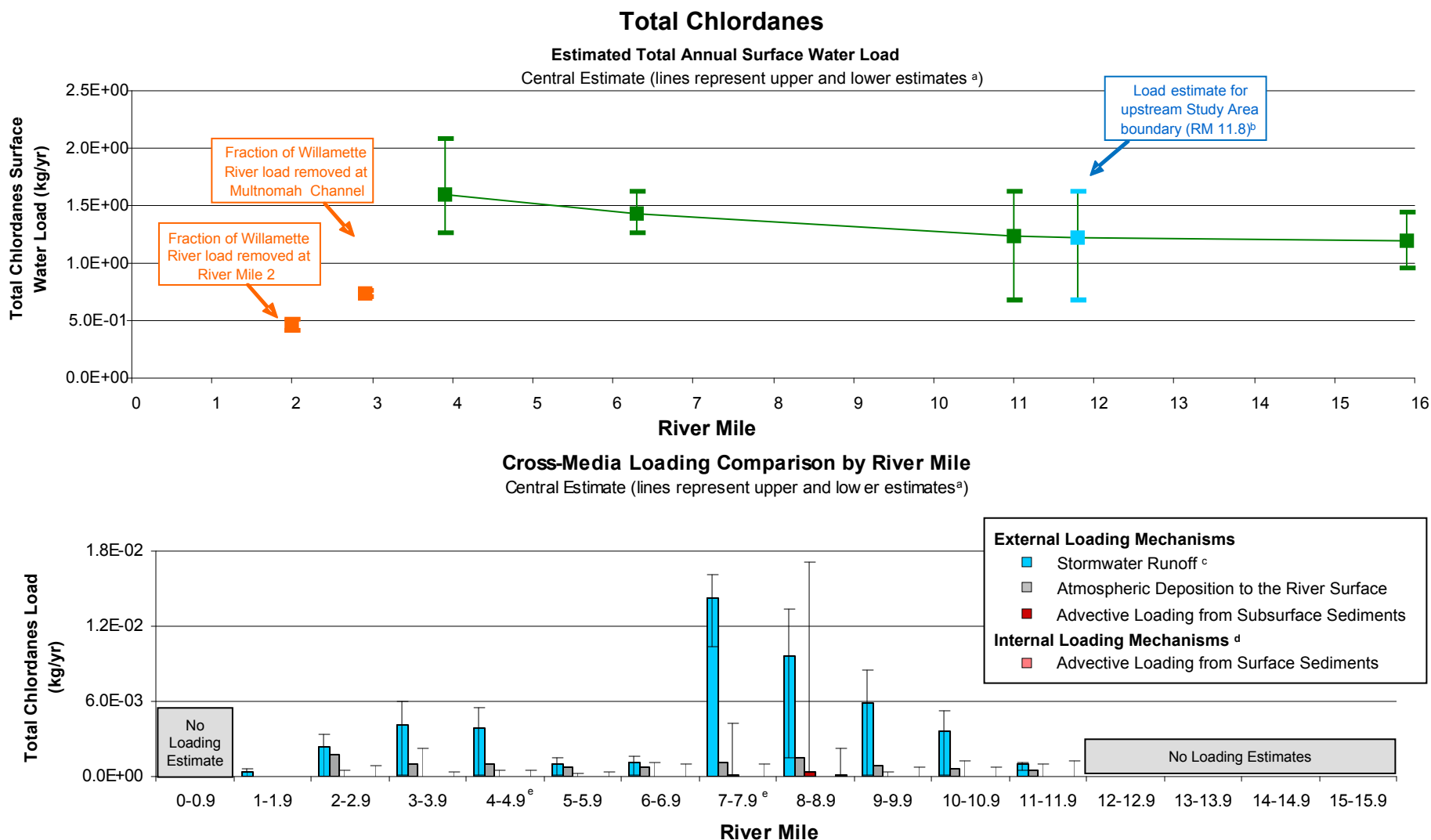
Figure 10.2-16b
 Portland Harbor RI/FS
 Remedial Investigation Report
 Box-Whisker Plots of Total Chlordanes Bulk and
 OC-Normalized Sediment, Sediment Trap,
 and Particulate Surface Water Concentrations

Total Chlordanes*



***Not a Mass Balance**

Figure 10.2-17
 Portland Harbor RI/FS
 Remedial Investigation Report
 Cross-Media Loading Box-Arrow Diagrams
 Total Chlordanes – Study Area Annual Central Loading Estimate



Notes:

^a Upper and lower estimates were generated based on available data and do not necessarily reflect uncertainty in estimate. Refer to text (Sections 6.1 and 10.2) for discussions of uncertainty in these loading estimates.

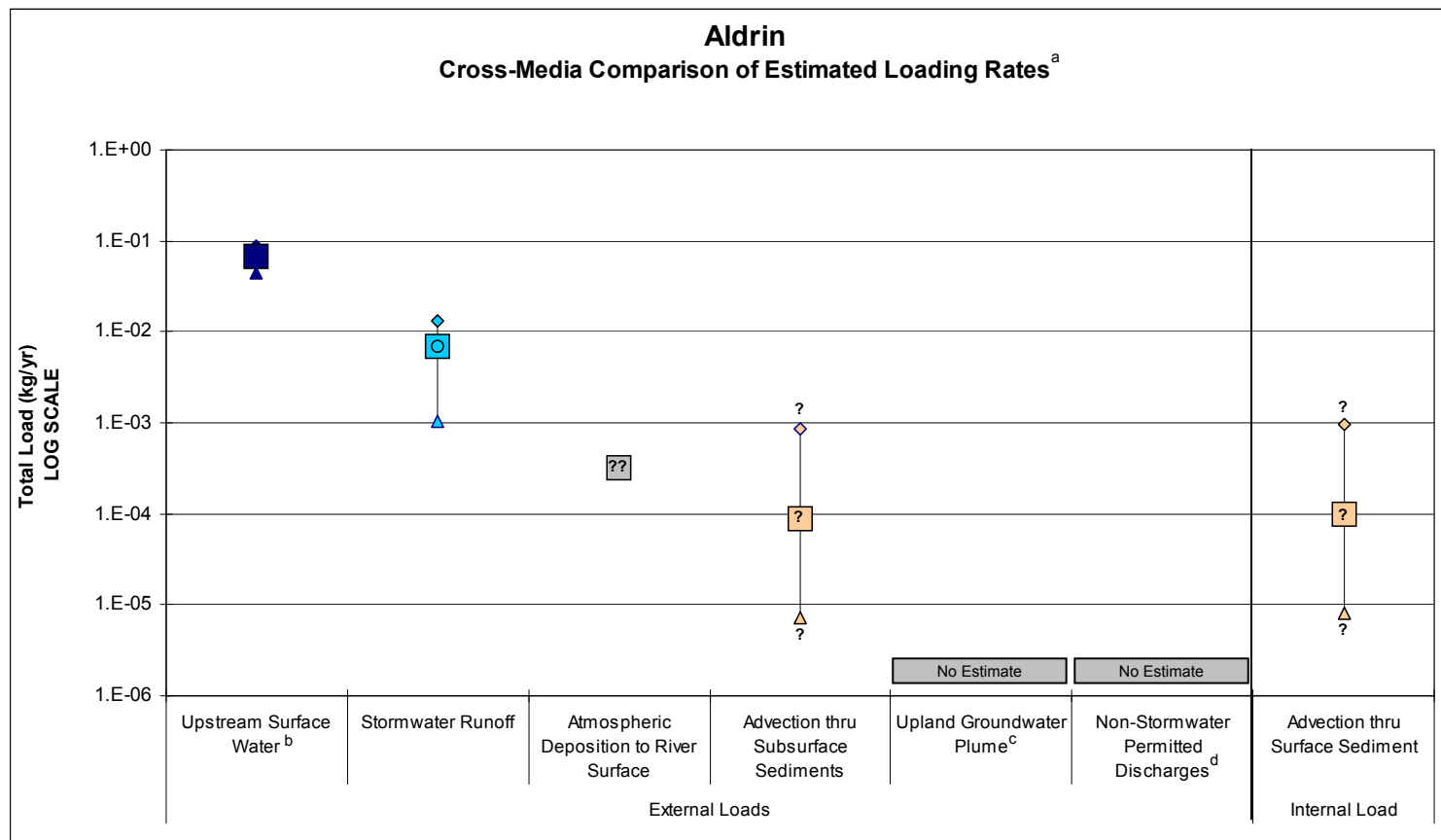
^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c Stormwater estimates were generated for individual model cells rather than by river mile. Model cells frequently cross river mile boundaries; therefore, the river mile categories presented here are only approximations of stormwater runoff loading areas.

^d Loading rates for internal mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^e Load estimate includes one or more non-representative sites which may lead to increased uncertainty related to the stormwater sampling program and load calculation methods (see Section 6.1.2.2).

Figure 10.2-18
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Load and Loading Comparison by River Mile
Total Chlordanes



Legend

Upstream Surface Water (RM 11.8), Total

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Stormwater Runoff

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate
- Area-weighted central estimate

Atmospheric Deposition to River Surface

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Advection thru Subsurface Sediments

- ◆ Upper estimate
- Primary estimate
- ▲ Lower estimate

Upland Groundwater Plume

- ◆ Unfiltered, central estimate
- Filtered, central estimate
- ▲ Filtered, lower estimate

Non-Stormwater Permitted Discharges

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

“?”

Indicates that the estimate is based on a combination of local data and non-local data/literature values.

“??”

Indicates that no local data were available for use in development of the estimate (based exclusively on non-local data/literature values).

Notes:

^a Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c The chemical was not identified as a COI for upland groundwater plumes with a known or likely complete pathway to the river; therefore, it was not included in the analyte list for TZW sampling. Consequently, no loading estimates were generated for upland plume loading for this chemical.

^d The chemical was not included for sampling on discharge permits (included permits defined in Section 6.1.3); therefore, there were no data to support loading calculations.

Figure 10.2-19a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Aldrin – Estimated Total Annual Study Area Loads

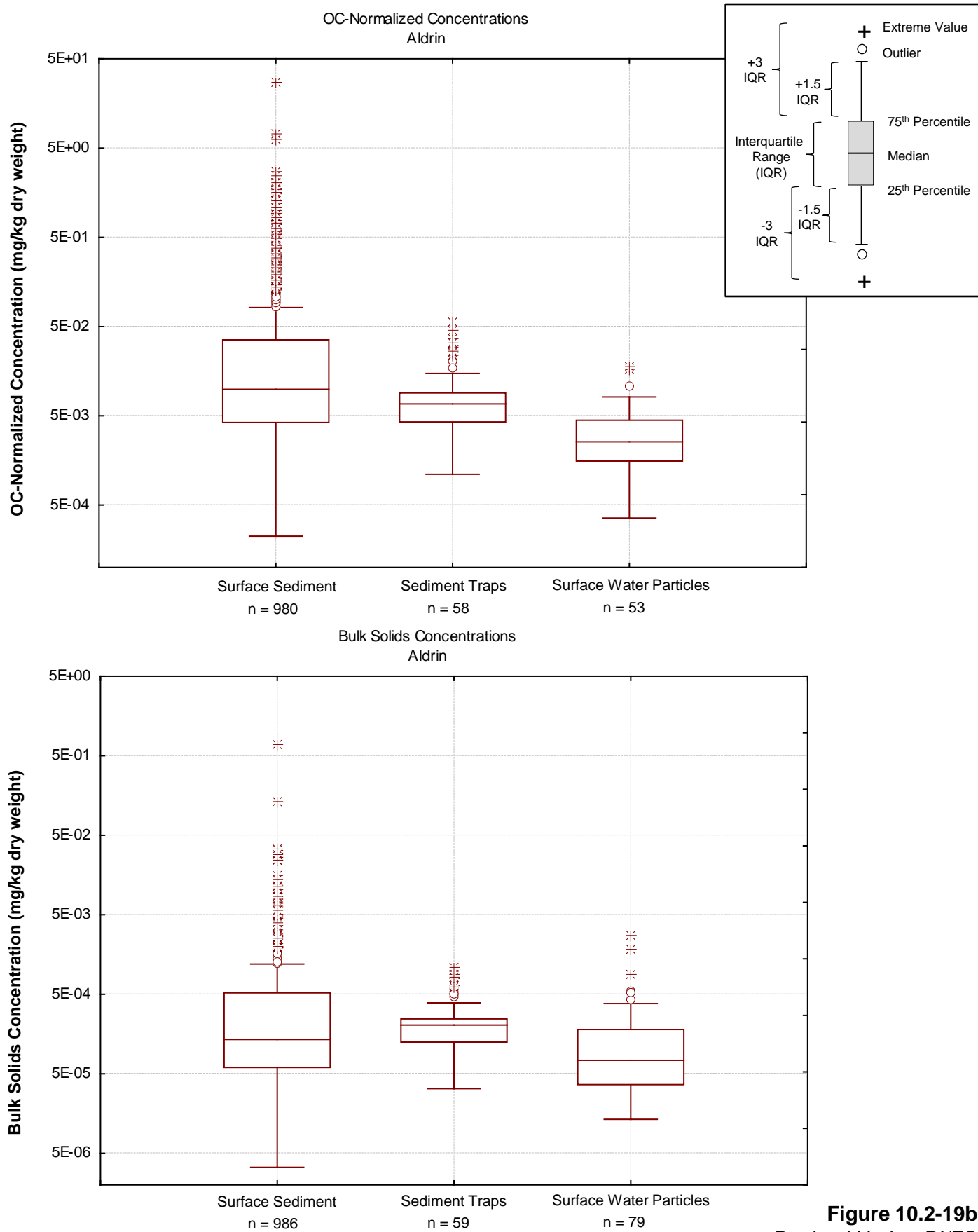
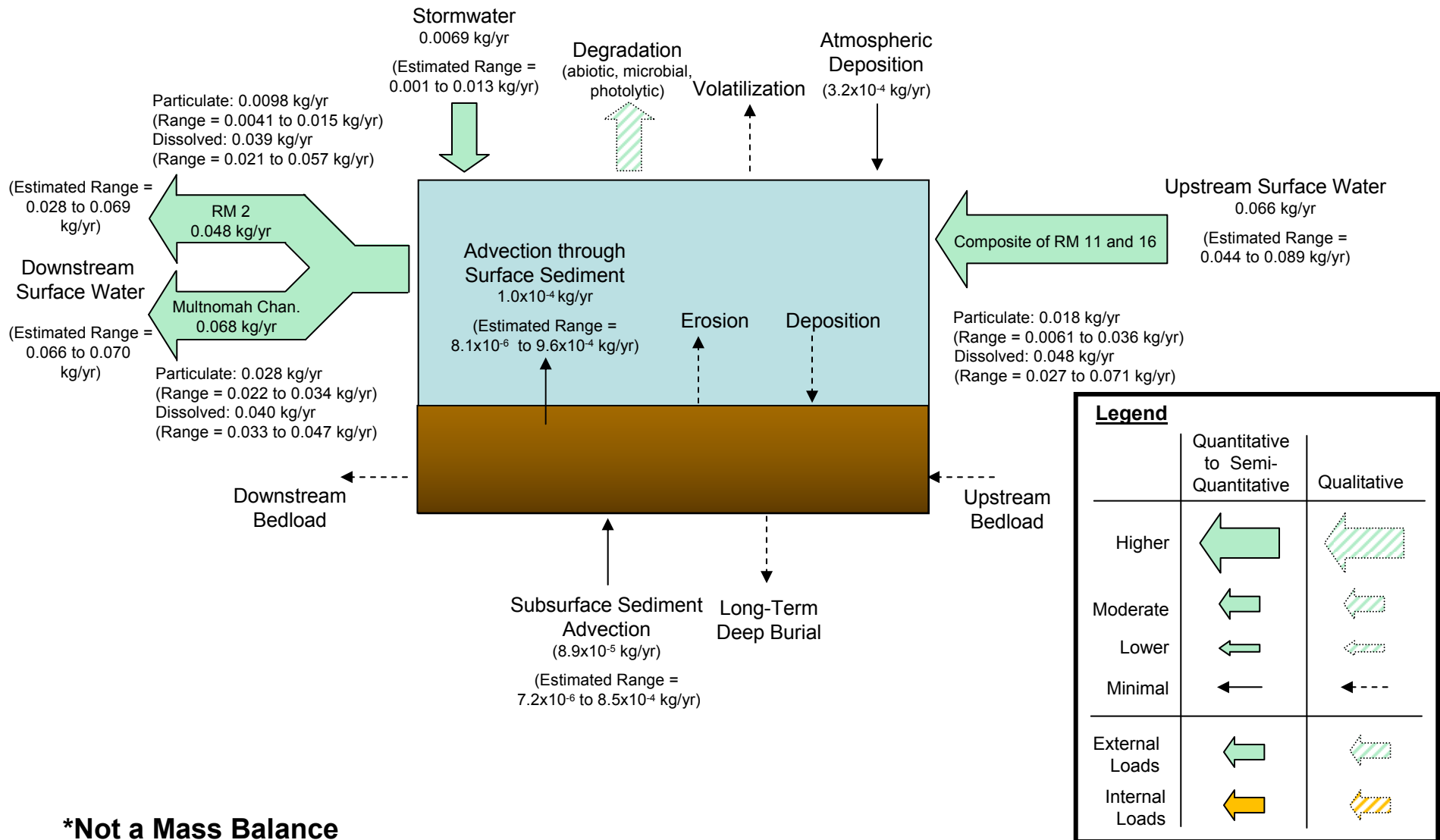


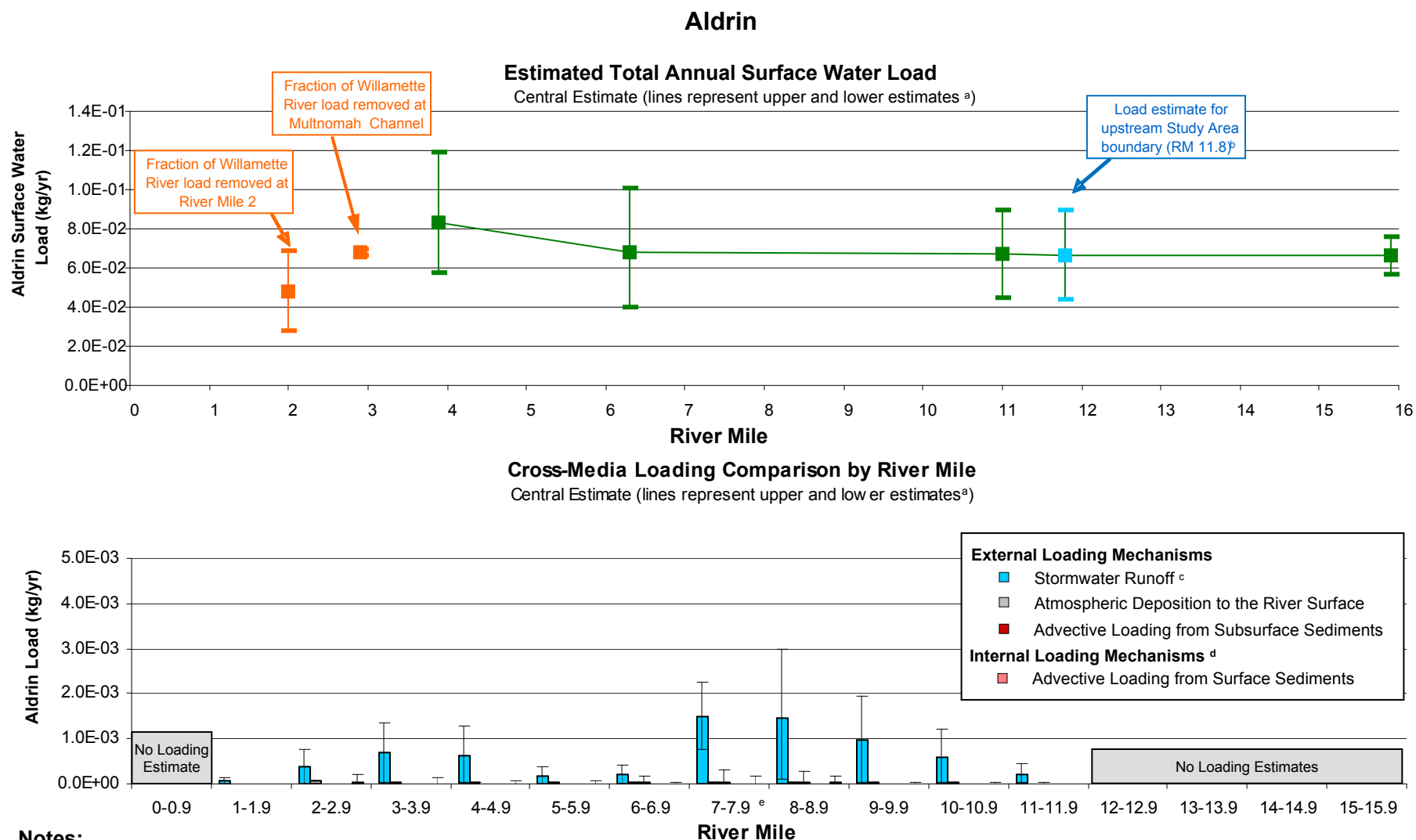
Figure 10.2-19b
 Portland Harbor RI/FS
 Remedial Investigation Report
 Box-Whisker Plots of Aldrin Bulk and
 OC-Normalized Sediment, Sediment Trap,
 and Particulate Surface Water Concentrations

Aldrin*



***Not a Mass Balance**

Figure 10.2-20
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
Aldrin – Study Area Annual Central Loading Estimate



Notes:

^a Upper and lower estimates were generated based on available data and do not necessarily reflect uncertainty in estimate. Refer to text (Sections 6.1 and 10.2) for discussions of uncertainty in these loading estimates.

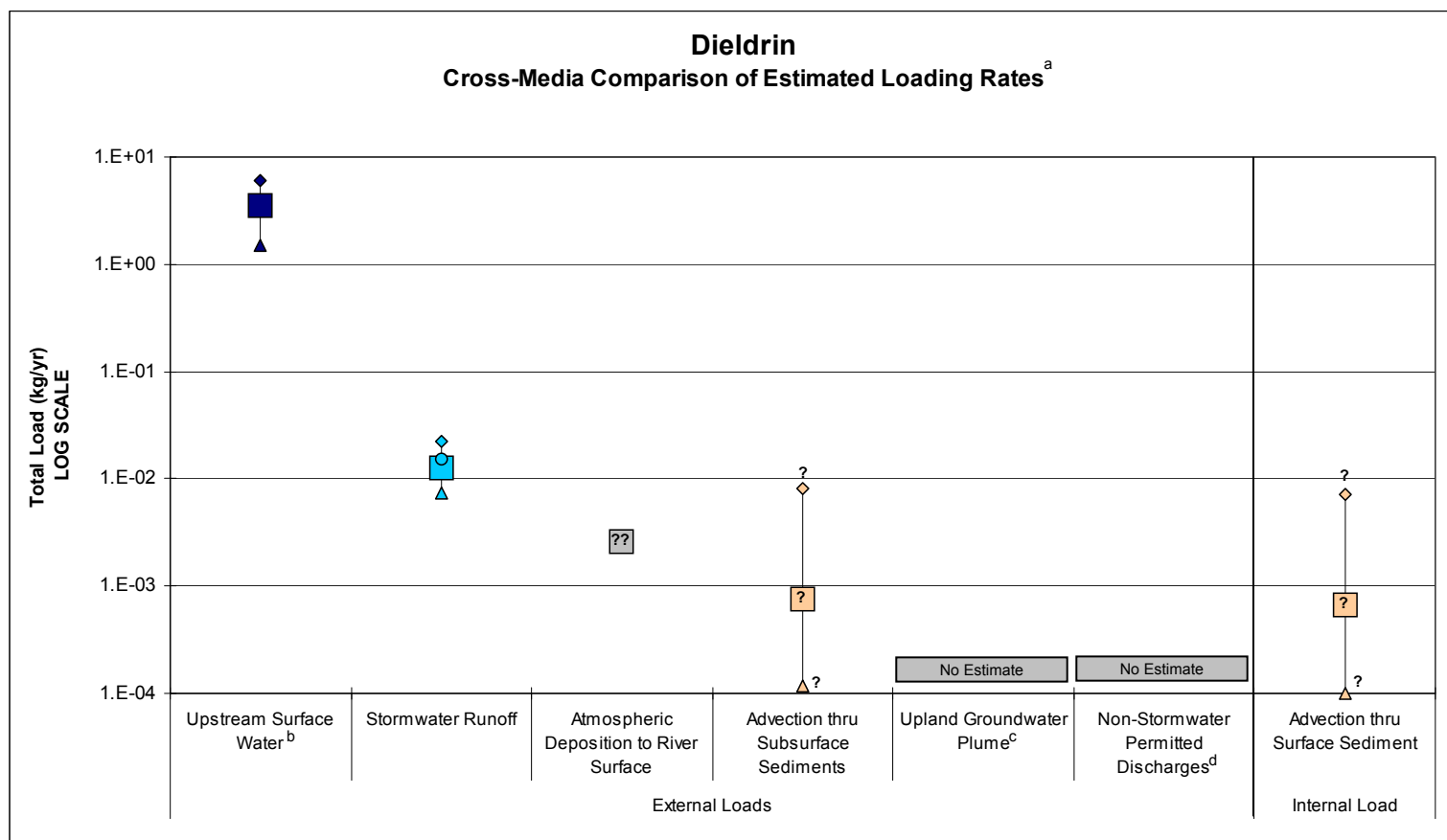
^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c Stormwater estimates were generated for individual model cells rather than by river mile. Model cells frequently cross river mile boundaries; therefore, the river mile categories presented here are only approximations of stormwater runoff loading areas.

^d Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^e Load estimate includes one or more non-representative sites which may lead to increased uncertainty related to the stormwater sampling program and load calculation methods (see Section 6.1.2.2).

Figure 10.2-21
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Load and Loading Comparison by River Mile
Aldrin



Legend

Upstream Surface Water (RM 11.8), Total

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Stormwater Runoff

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate
- Area-weighted central estimate

Atmospheric Deposition to River Surface

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Advection thru Subsurface Sediments

- ◆ Upper estimate
- Primary estimate
- ▲ Lower estimate

Upland Groundwater Plume

- ◆ Unfiltered, central estimate
- Filtered, central estimate
- ▲ Filtered, lower estimate

Non-Stormwater Permitted Discharges

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

“?”

Indicates that the estimate is based on a combination of local data and non-local data/literature values.

“??”

Indicates that no local data were available for use in development of the estimate (based exclusively on non-local data/literature values).

Notes:

^a Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c The chemical was not identified as a COI for upland groundwater plumes with a known or likely complete pathway to the river; therefore, it was not included in the analyte list for TZW sampling. Consequently, no loading estimates were generated for upland plume loading for this chemical.

^d The chemical was not included for sampling on discharge permits (included permits defined in Section 6.1.3); therefore, there were no data to support loading calculations.

Figure 10.2-22a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Dieldrin – Estimated Total Annual Study Area Loads

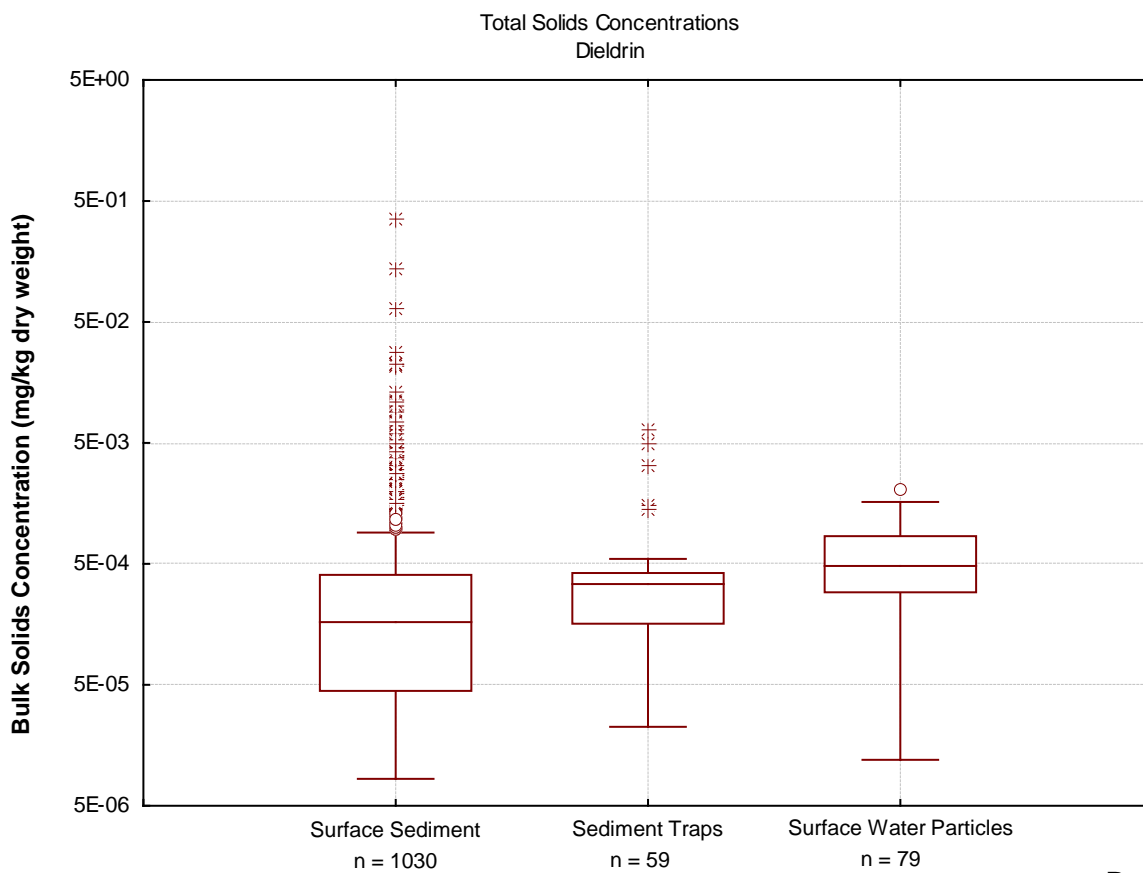
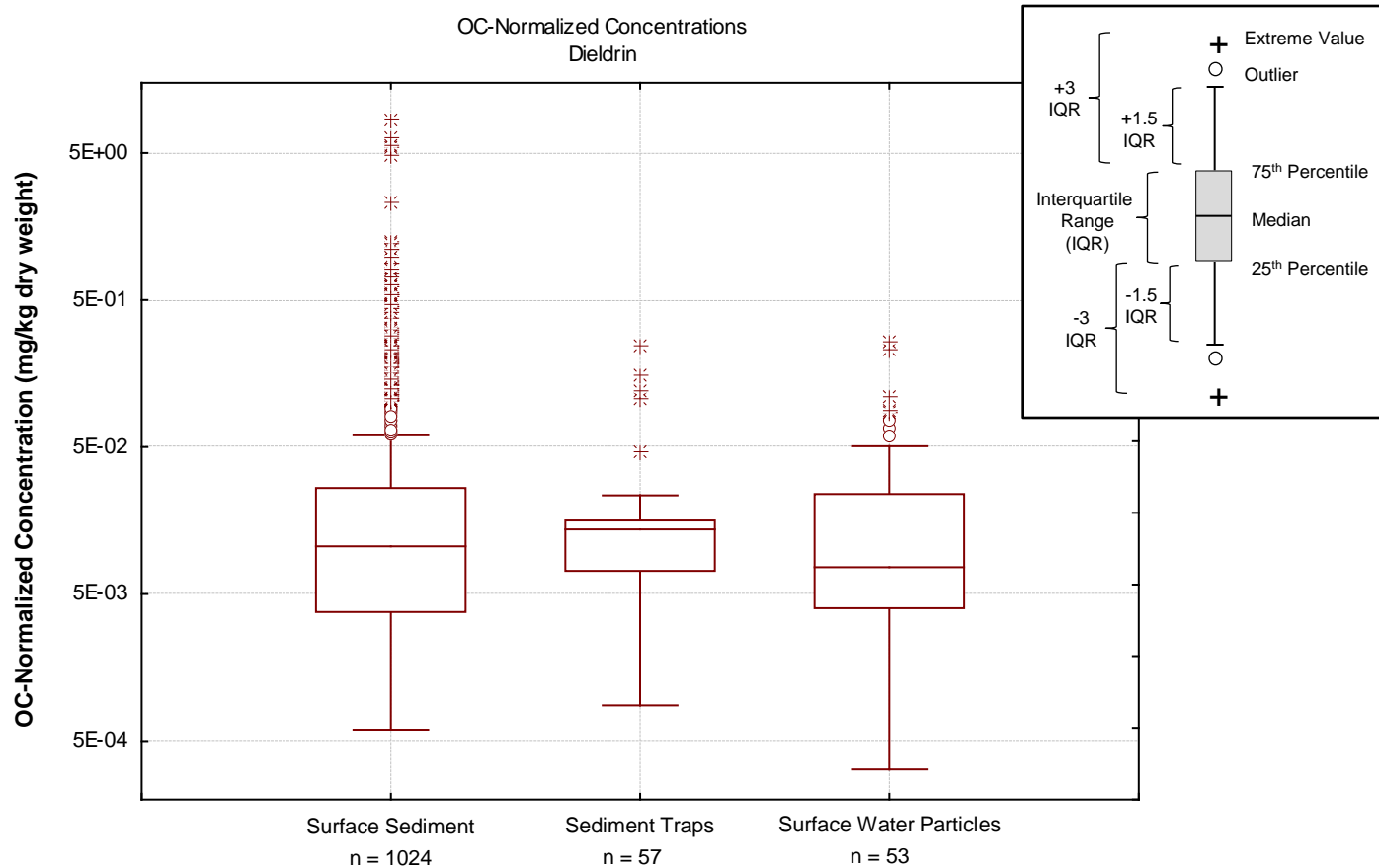
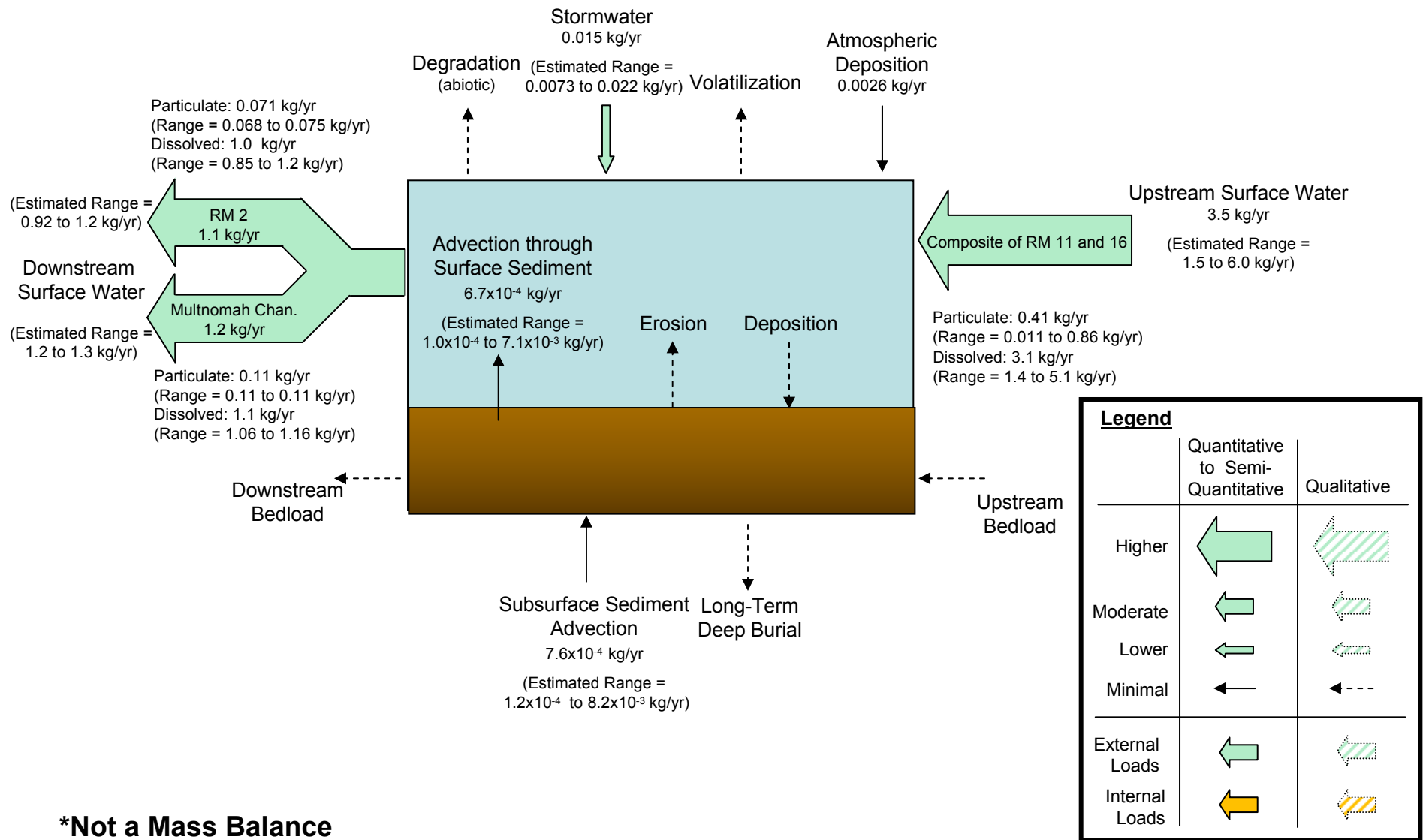


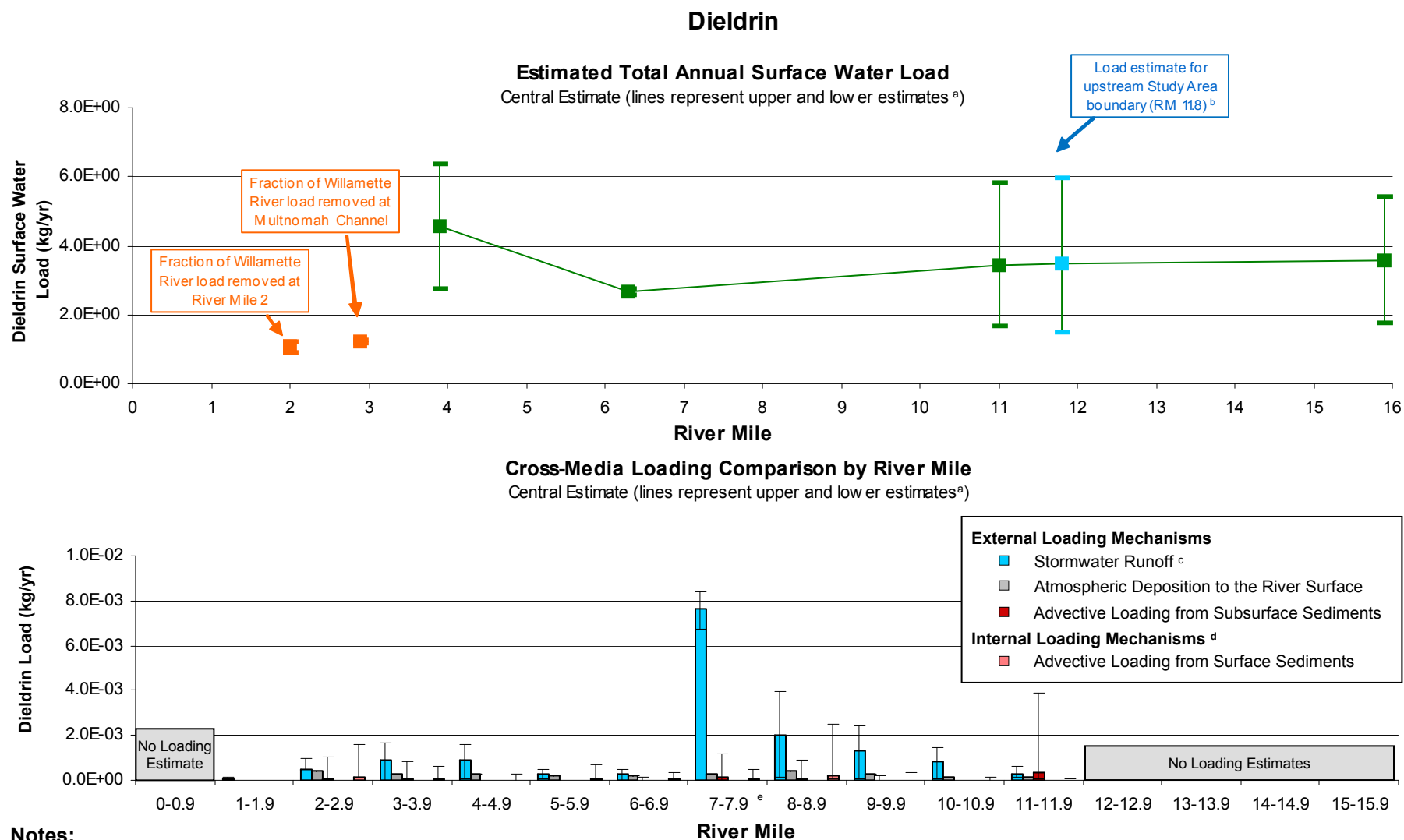
Figure 10.2-22b
Portland Harbor RI/FS
Remedial Investigation Report
Box-Whisker Plots of Dieldrin Bulk and
OC-Normalized Sediment, Sediment Trap,
and Particulate Surface Water Concentrations

Dieldrin*



***Not a Mass Balance**

Figure 10.2-23
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
Dieldrin – Study Area Annual Central Loading Estimate



Notes:

^a Upper and lower estimates were generated based on available data and do not necessarily reflect uncertainty in estimate. Refer to text (Sections 6.1 and 10.2) for discussions of uncertainty in these loading estimates.

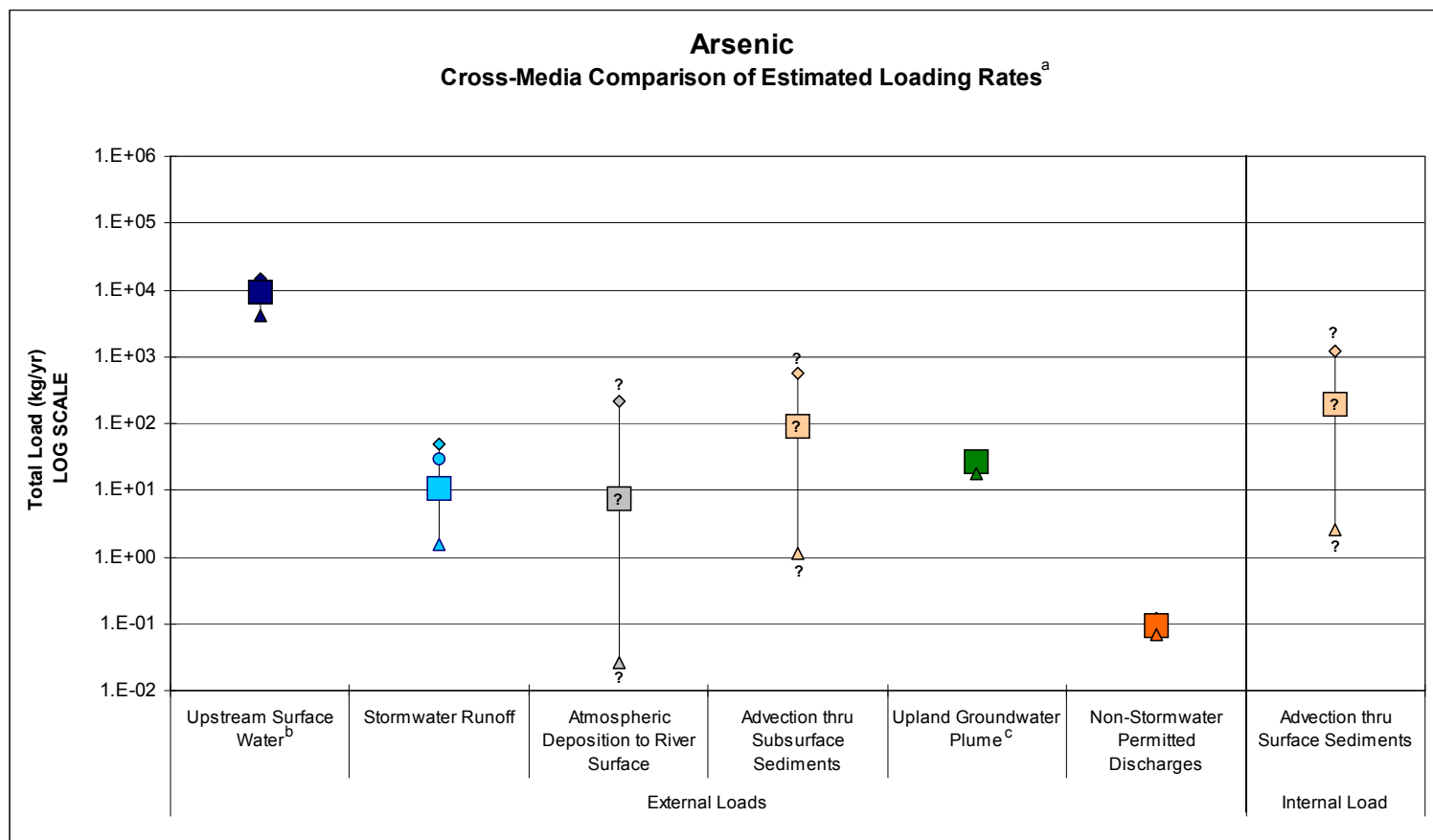
^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c Stormwater estimates were generated for individual model cells rather than by river mile. Model cells frequently cross river mile boundaries; therefore, the river mile categories presented here are only approximations of stormwater runoff loading areas.

^d Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^e Load estimate includes one or more non-representative sites which may lead to increased uncertainty related to the stormwater sampling program and load calculation methods (see Section 6.1.2.2).

Figure 10.2-24
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Load and Loading Comparison by River Mile
Dieldrin



Legend

Upstream Surface Water (RM 11.8), Total

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Stormwater Runoff

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate
- Area-weighted central estimate

Atmospheric Deposition to River Surface

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Advection thru Subsurface Sediments

- ◆ Upper estimate
- Primary estimate
- ▲ Lower estimate

Upland Groundwater Plume

- ◆ Unfiltered, central estimate
- Filtered, central estimate
- ▲ Filtered, lower estimate

Non-Stormwater Permitted Discharges

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

“?”

Indicates that the estimate is based on a combination of local data and non-local data/literature values.

“??”

Indicates that no local data were available for use in development of the estimate (based exclusively on non-local data/literature values).

Notes:

^a Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c In areas where indicator contaminants in pore water are attributable to both upland groundwater plumes and in-river sediment sources (advective loading), the plume loading estimates (based on empirical measurements of pore water flows and concentrations) include the advective load also. Note that loading estimates for the fate and transport model will not include this redundancy.

Figure 10.2-25a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Arsenic – Estimated Total Annual Study Area Loads

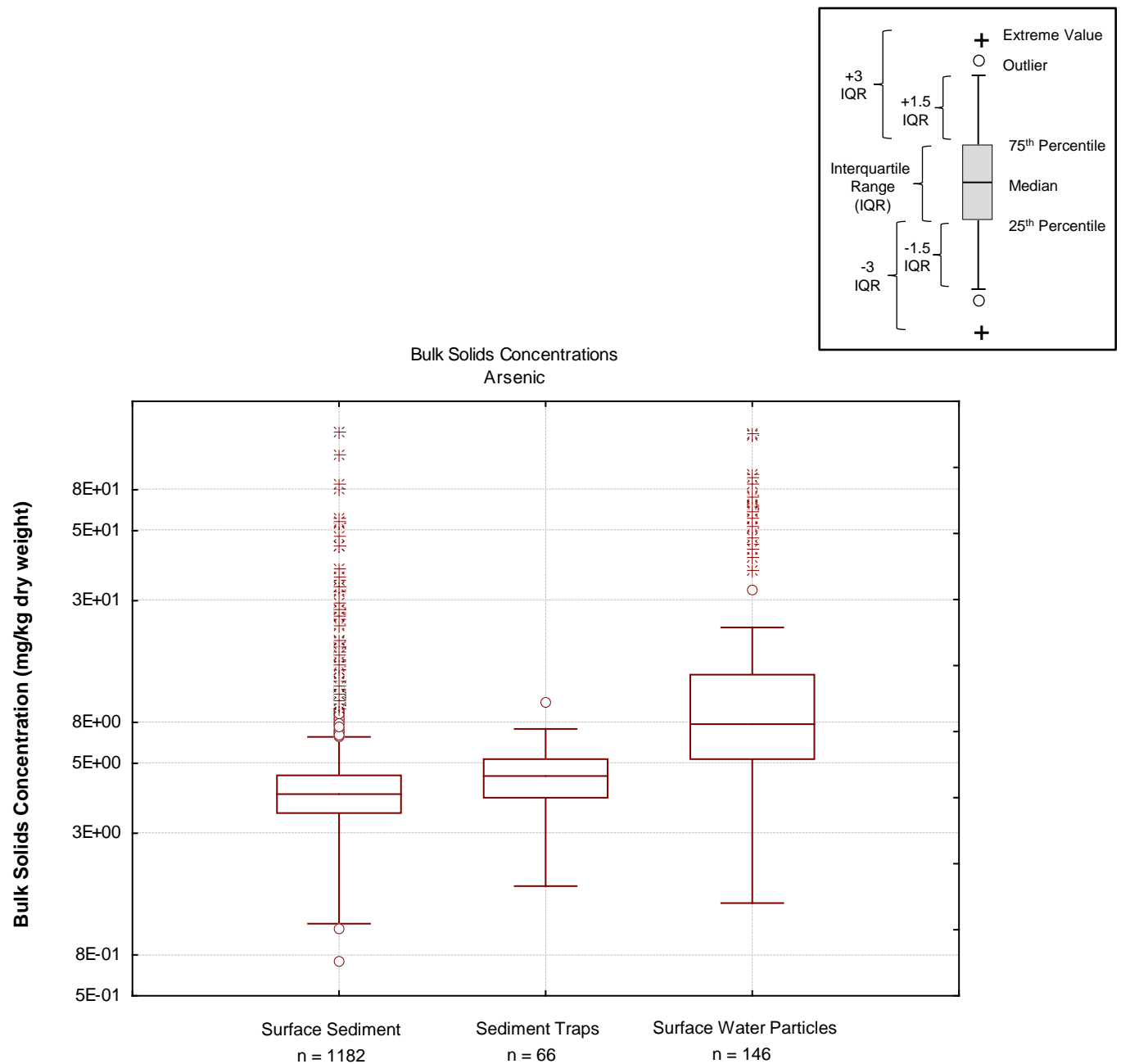
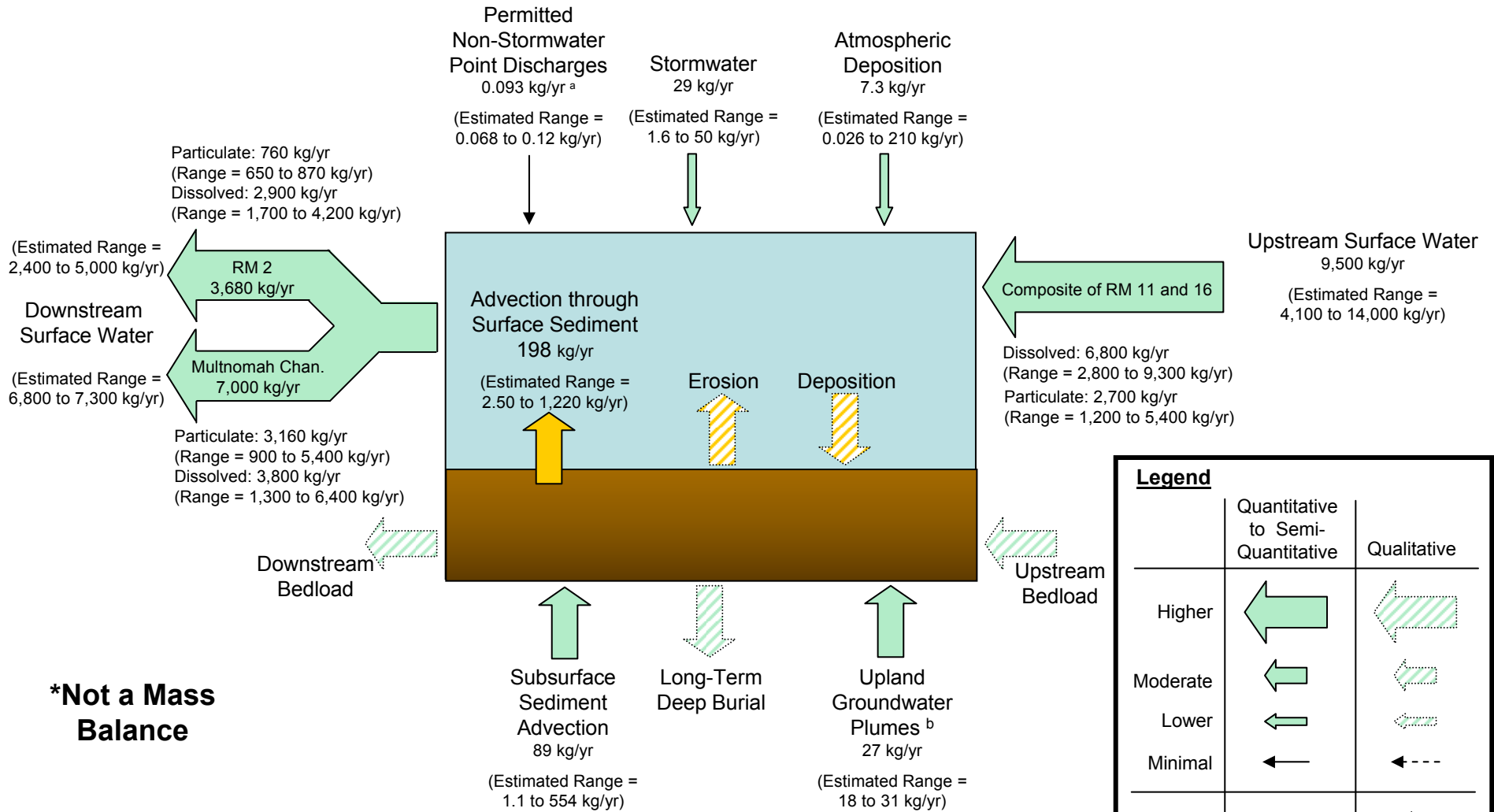


Figure 10.2-25b
 Portland Harbor RI/FS
 Remedial Investigation Report
 Box-Whisker Plot of Arsenic
 Bulk Sediment, Sediment Trap,
 and Particulate Surface Water Concentrations

Arsenic*



***Not a Mass Balance**

Notes:

^a Sum of trivalent and pentavalent arsenic.

^b Note: In areas where indicator contaminants in pore water are attributable to both upland groundwater plumes and in-river sediment sources (advective loading), the plume loading estimates (based on empirical measurements of pore water flows and concentrations) include the advective load also. Note that loading estimates for the fate and transport model will not include this redundancy.

Figure 10.2-26
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
Arsenic – Study Area Annual Central Loading Estimate

Arsenic

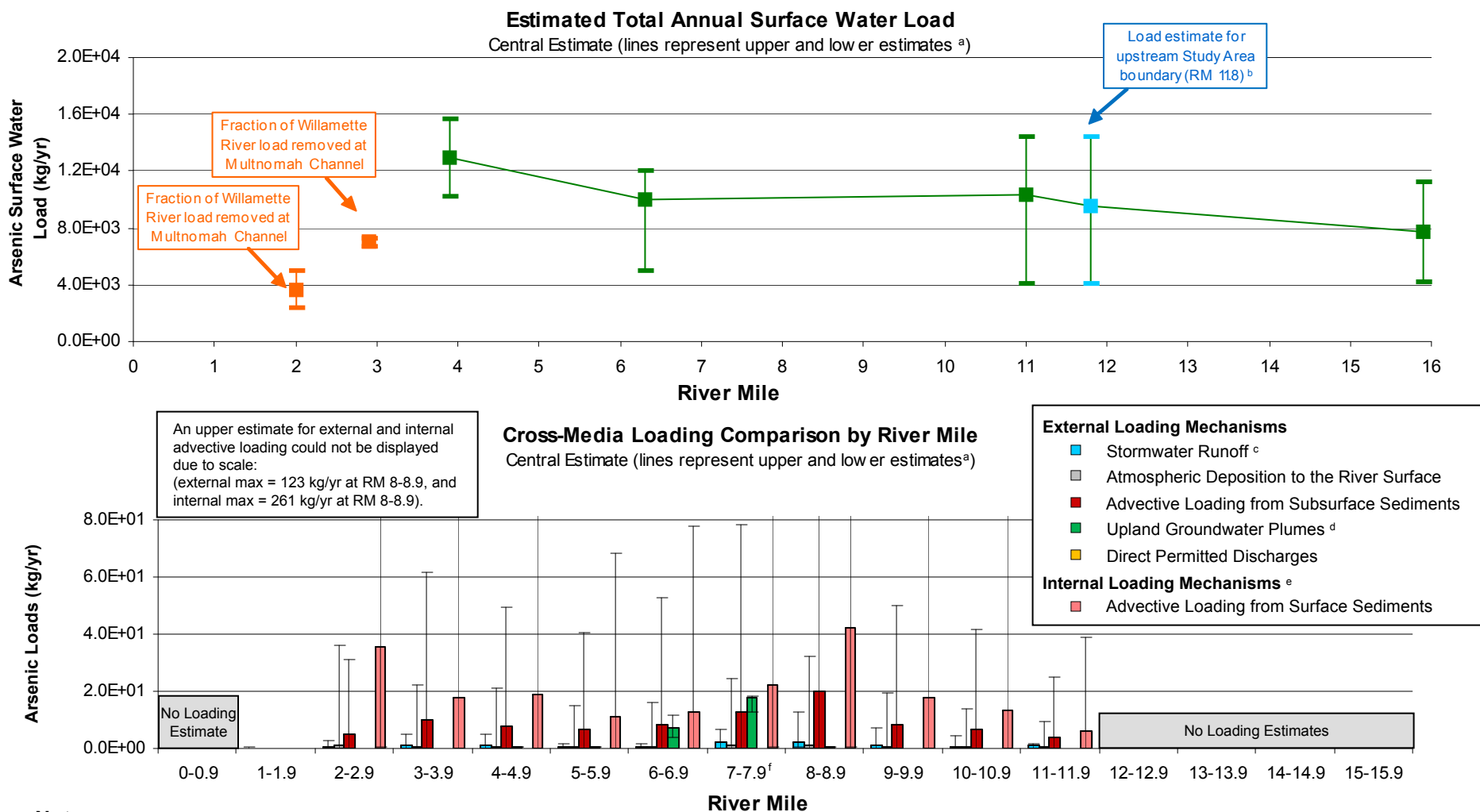
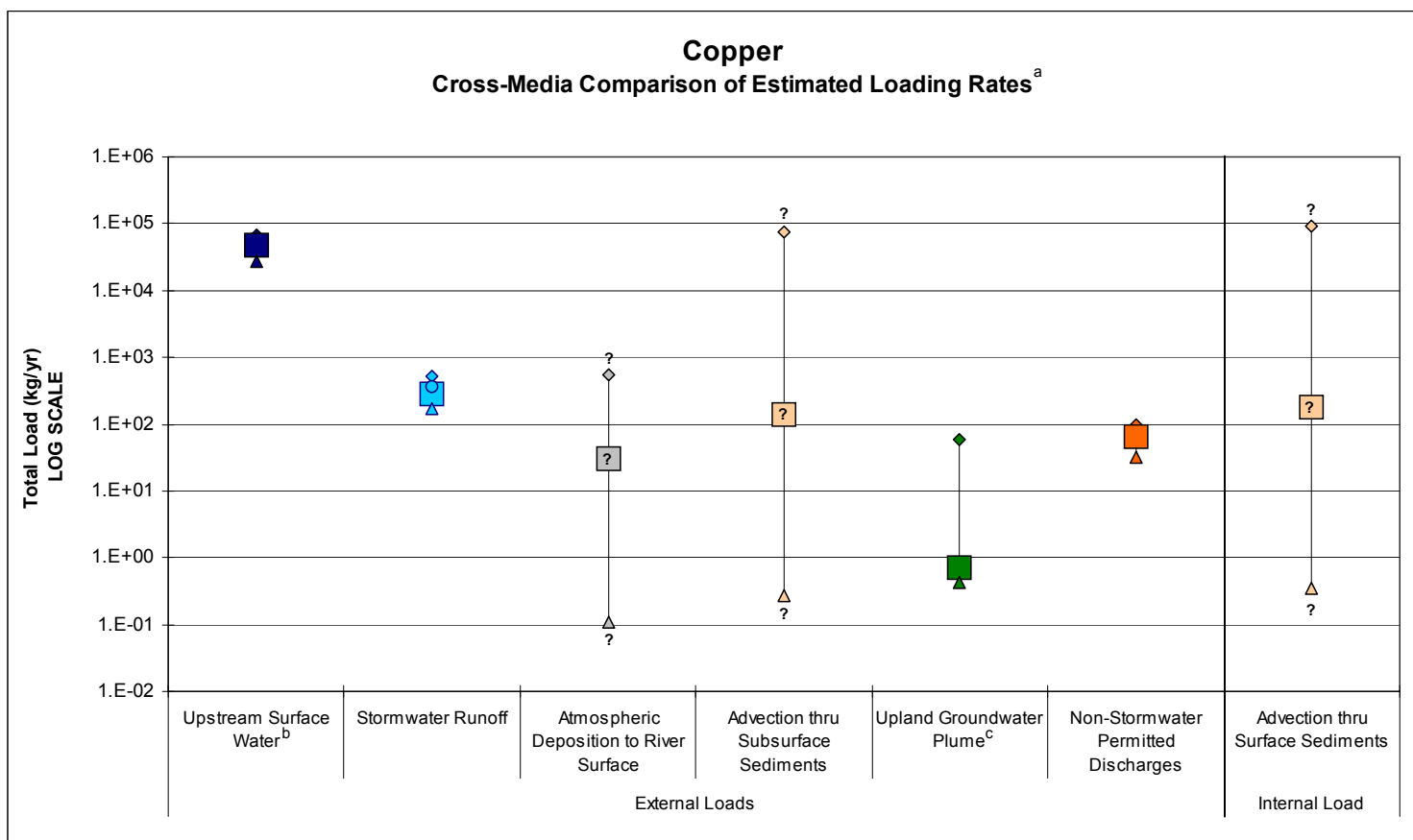


Figure 10.2-27
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Load and Loading Comparison by River Mile
Arsenic



Legend

Upstream Surface Water (RM 11.8), Total

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Stormwater Runoff

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate
- Area-weighted central estimate

Atmospheric Deposition to River Surface

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Advection thru Subsurface Sediments

- ◆ Upper estimate
- Primary estimate
- ▲ Lower estimate

Upland Groundwater Plume

- ◆ Unfiltered, central estimate
- Filtered, central estimate
- ▲ Filtered, lower estimate

Non-Stormwater Permitted Discharges

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

“?”

Indicates that the estimate is based on a combination of local data and non-local data/literature values.

“??”

Indicates that no local data were available for use in development of the estimate (based exclusively on non-local data/literature values).

Notes:

^a Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c In areas where indicator contaminants in pore water are attributable to both upland groundwater plumes and in-river sediment sources (advective loading), the plume loading estimates (based on empirical measurements of pore water flows and concentrations) include the advective load also. Note that loading estimates for the fate and transport model will not include this redundancy.

Figure 10.2-28a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Copper – Estimated Total Annual Study Area Loads

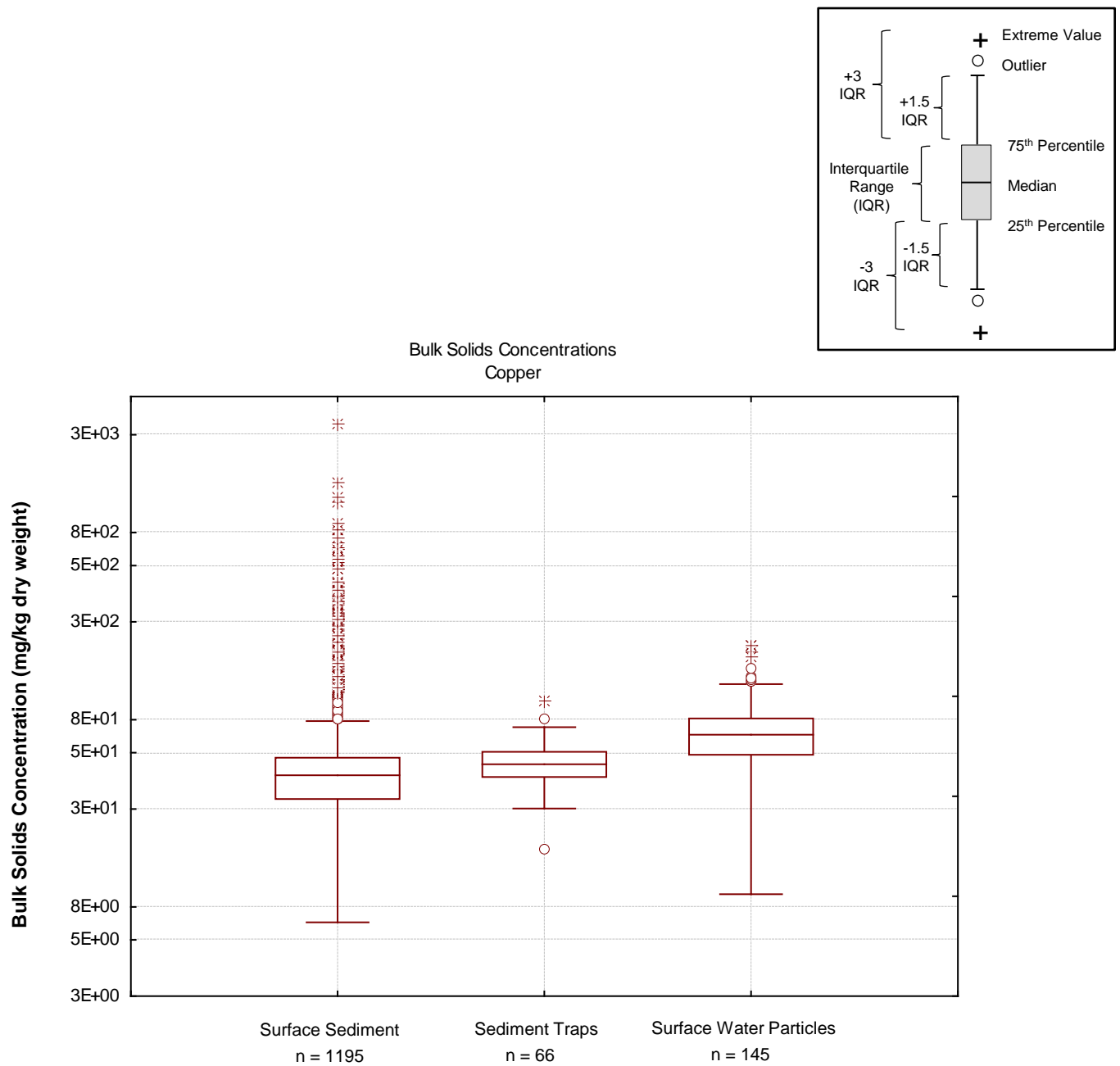


Figure 10.2-28b
Portland Harbor RI/FS
Remedial Investigation Report
Box-Whisker Plot of Copper
Bulk Sediment, Sediment Trap,
and Particulate Surface Water Concentrations

Copper*

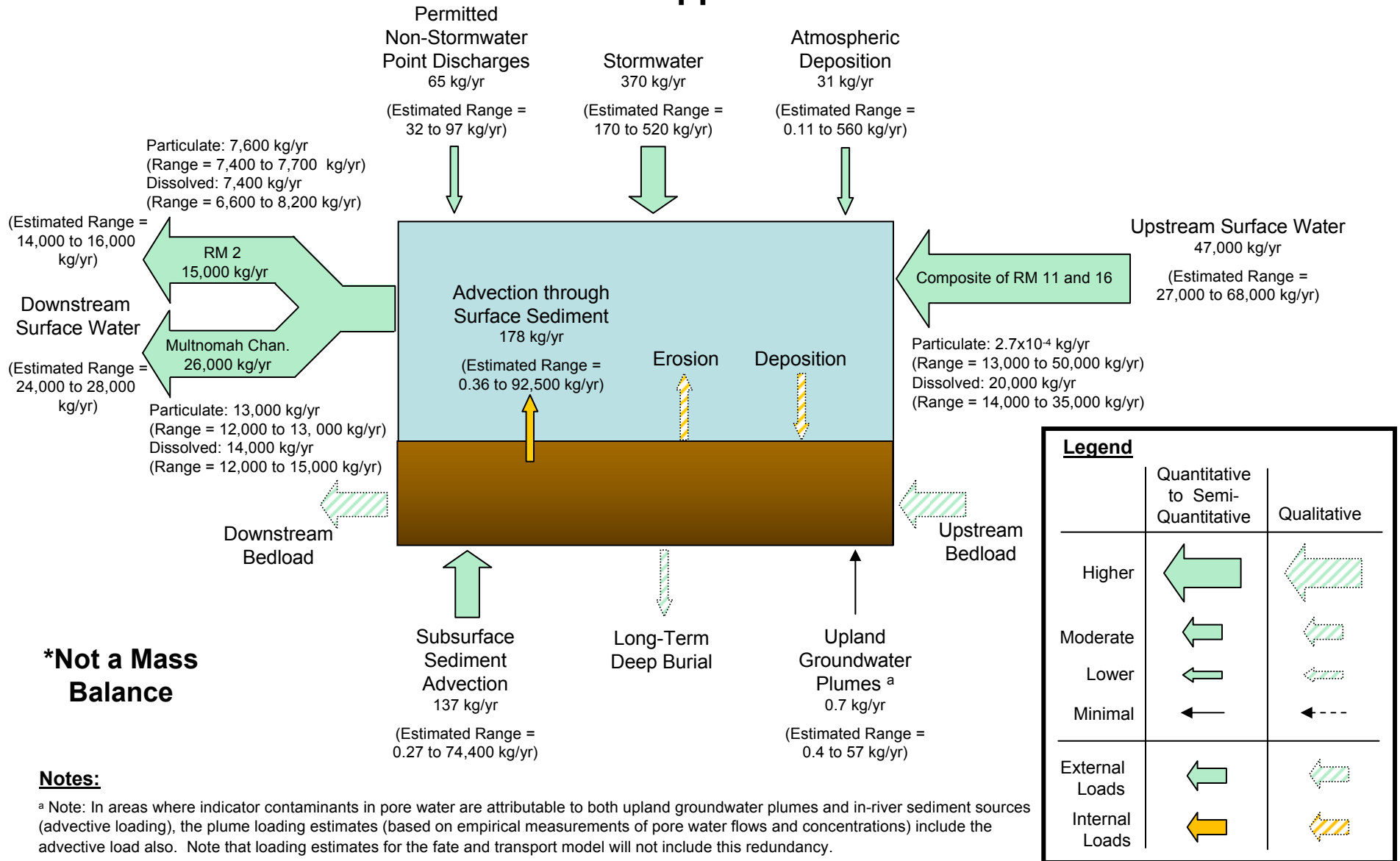
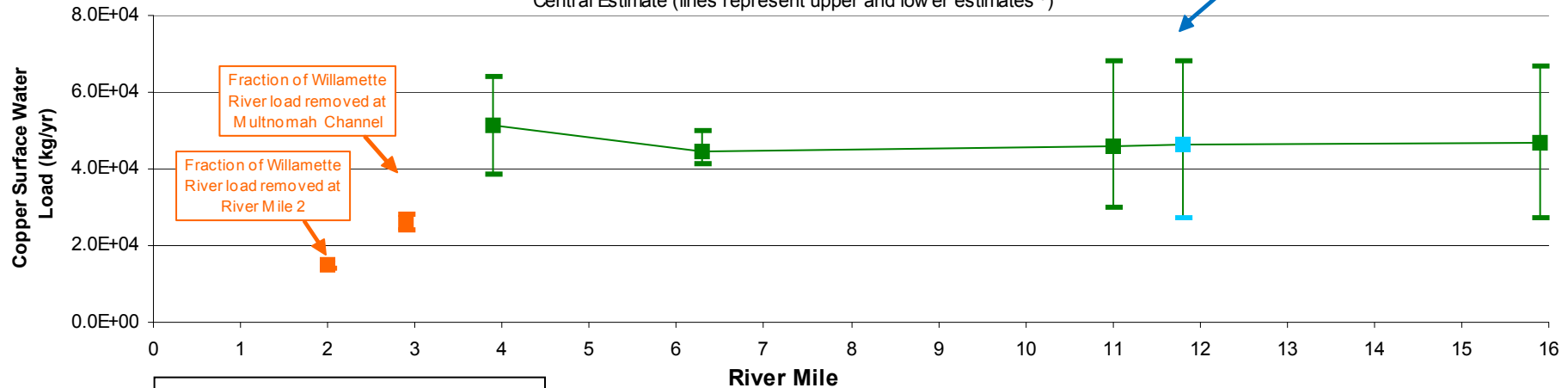


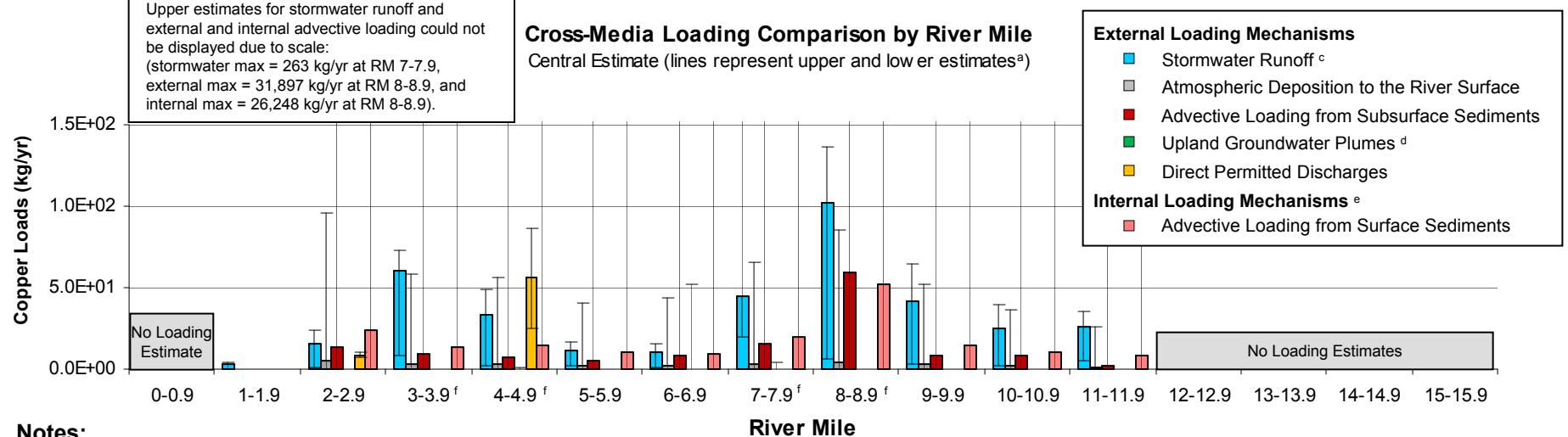
Figure 10.2-29
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
Copper – Study Area Annual Central Loading Estimate

Copper

Estimated Total Annual Surface Water Load Central Estimate (lines represent upper and lower estimates^a)



Cross-Media Loading Comparison by River Mile Central Estimate (lines represent upper and lower estimates^a)



Notes:

^a Upper and lower estimates were generated based on available data and do not necessarily reflect uncertainty in estimate. Refer to text (Sections 6.1 and 10.2) for discussions of uncertainty in these loading estimates.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

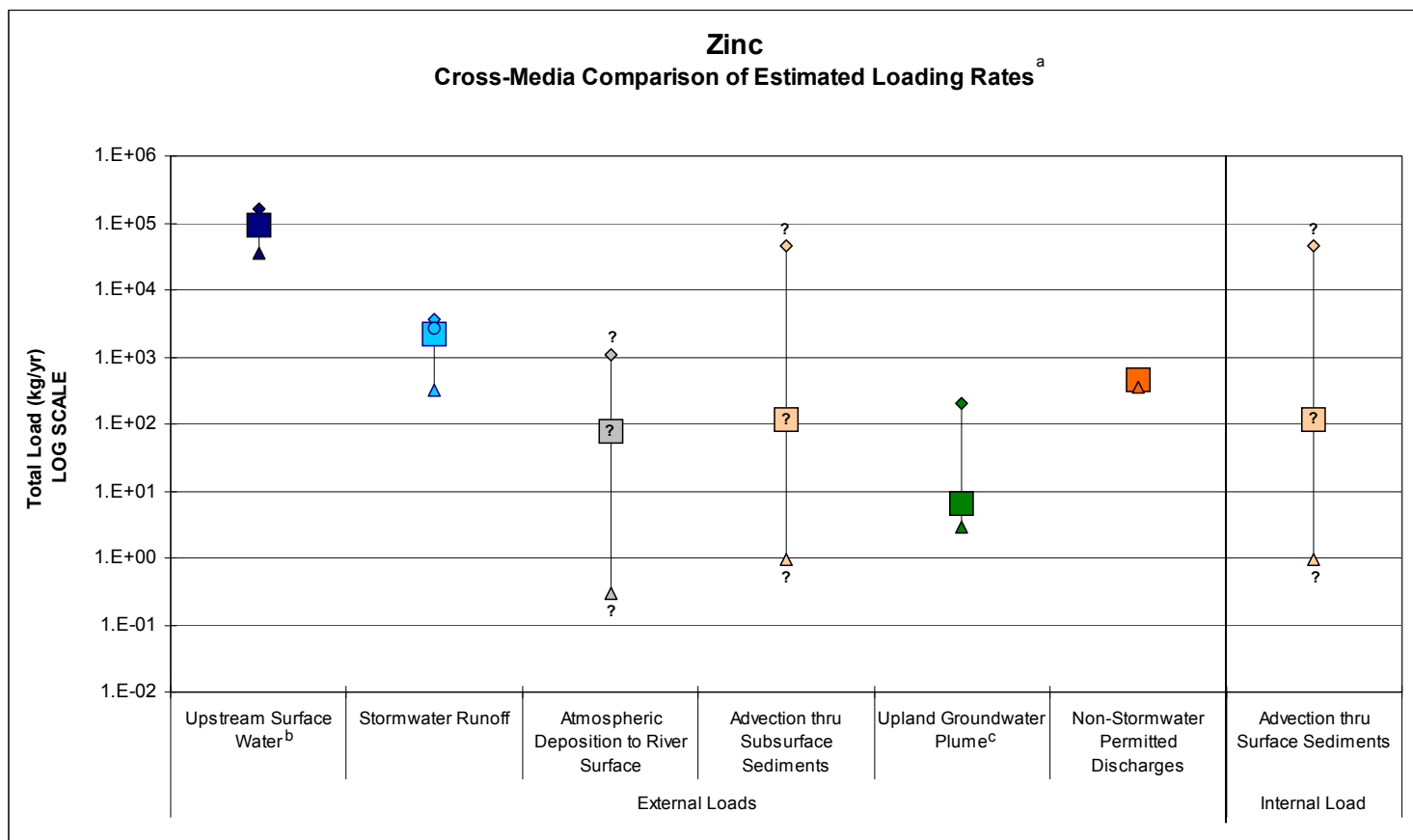
^c Stormwater estimates were generated for individual model cells rather than by river mile. Model cells frequently cross river mile boundaries; therefore, the river mile categories presented here are only approximations of stormwater runoff loading areas.

^d In areas where indicator contaminants in pore water are attributable to both upland groundwater plumes and in-river sediment sources (advective loading), the plume loading estimates (based on empirical measurements of pore water flows and concentrations) include the advective load also. Note that loading estimates for the fate and transport model will not include this redundancy.

^e Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^f Load estimate includes one or more non-representative sites which may lead to increased uncertainty related to the stormwater sampling program and load calculation methods (see Section 6.1.2.2).

Figure 10.2-30
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Load and Loading Comparison by River Mile
Copper



Legend

Upstream Surface Water (RM 11.8), Total

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Stormwater Runoff

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate
- Area-weighted central estimate

Atmospheric Deposition to River Surface

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Advection thru Subsurface Sediments

- ◆ Upper estimate
- Primary estimate
- ▲ Lower estimate

Upland Groundwater Plume

- ◆ Unfiltered, central estimate
- Filtered, central estimate
- ▲ Filtered, lower estimate

Non-Stormwater Permitted Discharges

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

- “?” Indicates that the estimate is based on a combination of local data and non-local data/literature values.
- “??” Indicates that no local data were available for use in development of the estimate (based exclusively on non-local data/literature values).

Notes:

^a Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c In areas where indicator contaminants in pore water are attributable to both upland groundwater plumes and in-river sediment sources (advective loading), the plume loading estimates (based on empirical measurements of pore water flows and concentrations) include the advective load also. Note that loading estimates for the fate and transport model will not include this redundancy.

Figure 10.2-31a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Zinc – Estimated Total Annual Study Area Loads

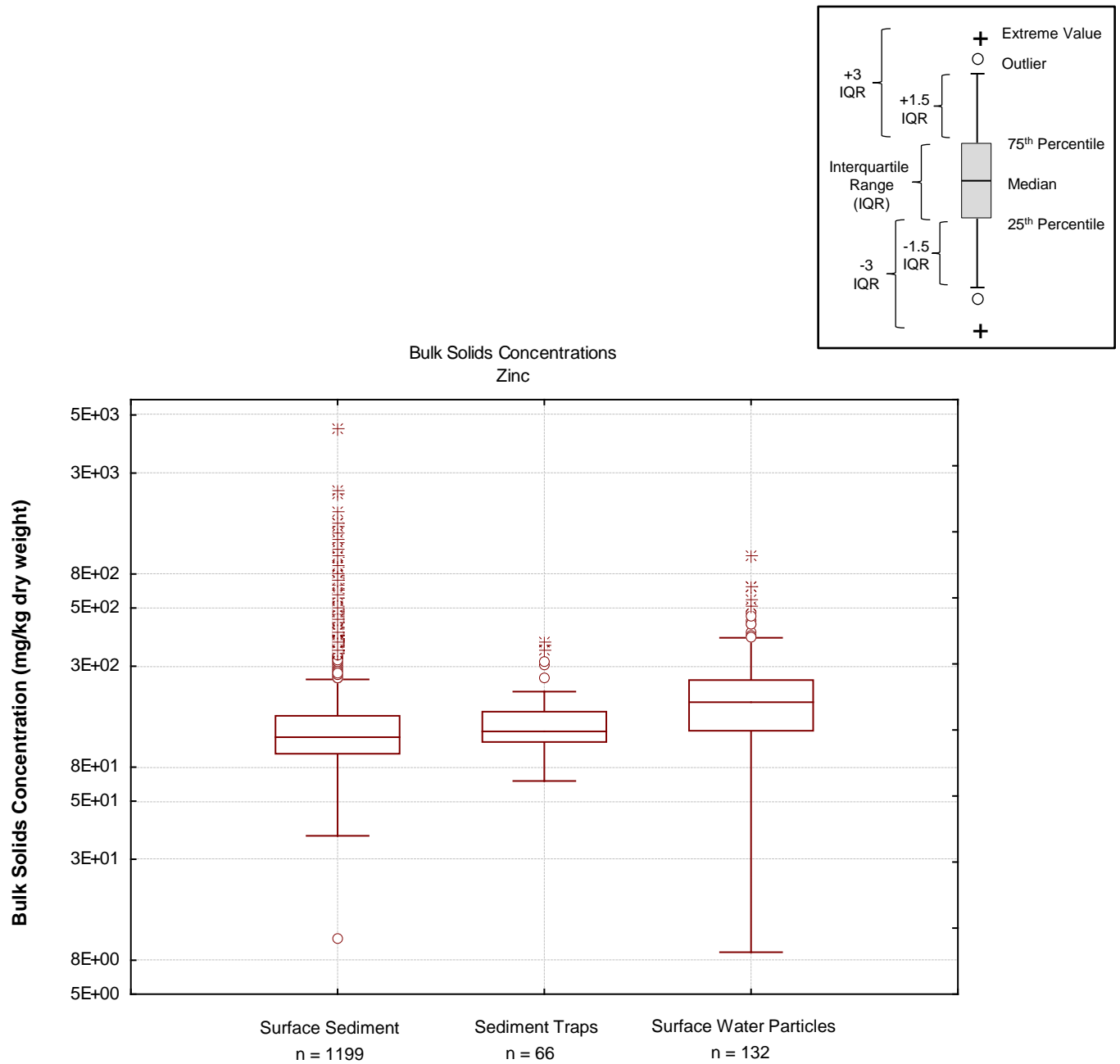


Figure 10.2-31b
 Portland Harbor RI/FS
 Remedial Investigation Report
 Box-Whisker Plot of Zinc
 Bulk Sediment, Sediment Trap,
 and Particulate Surface Water Concentrations

Zinc*

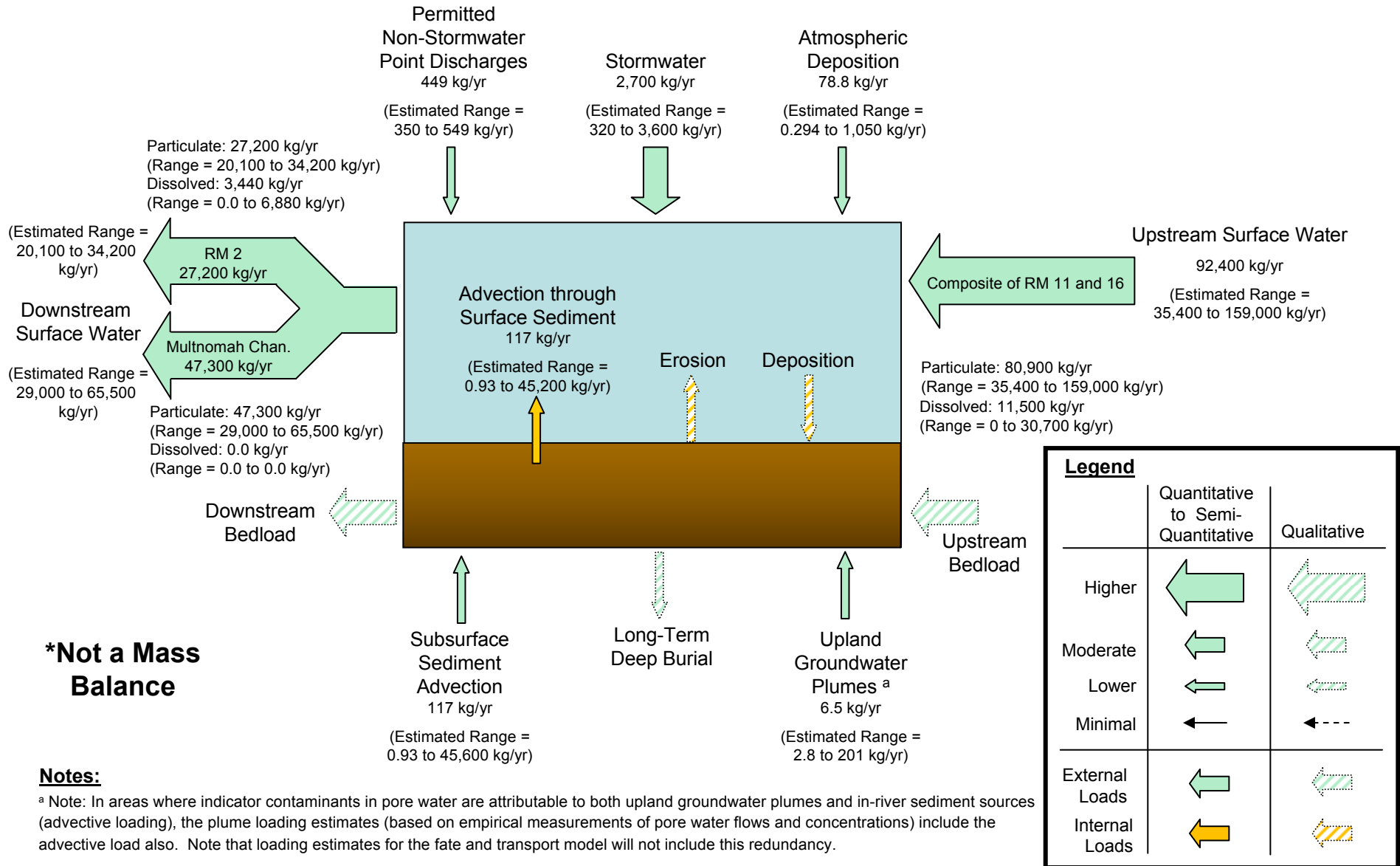


Figure 10.2-32
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
Zinc – Study Area Annual Central Loading Estimate

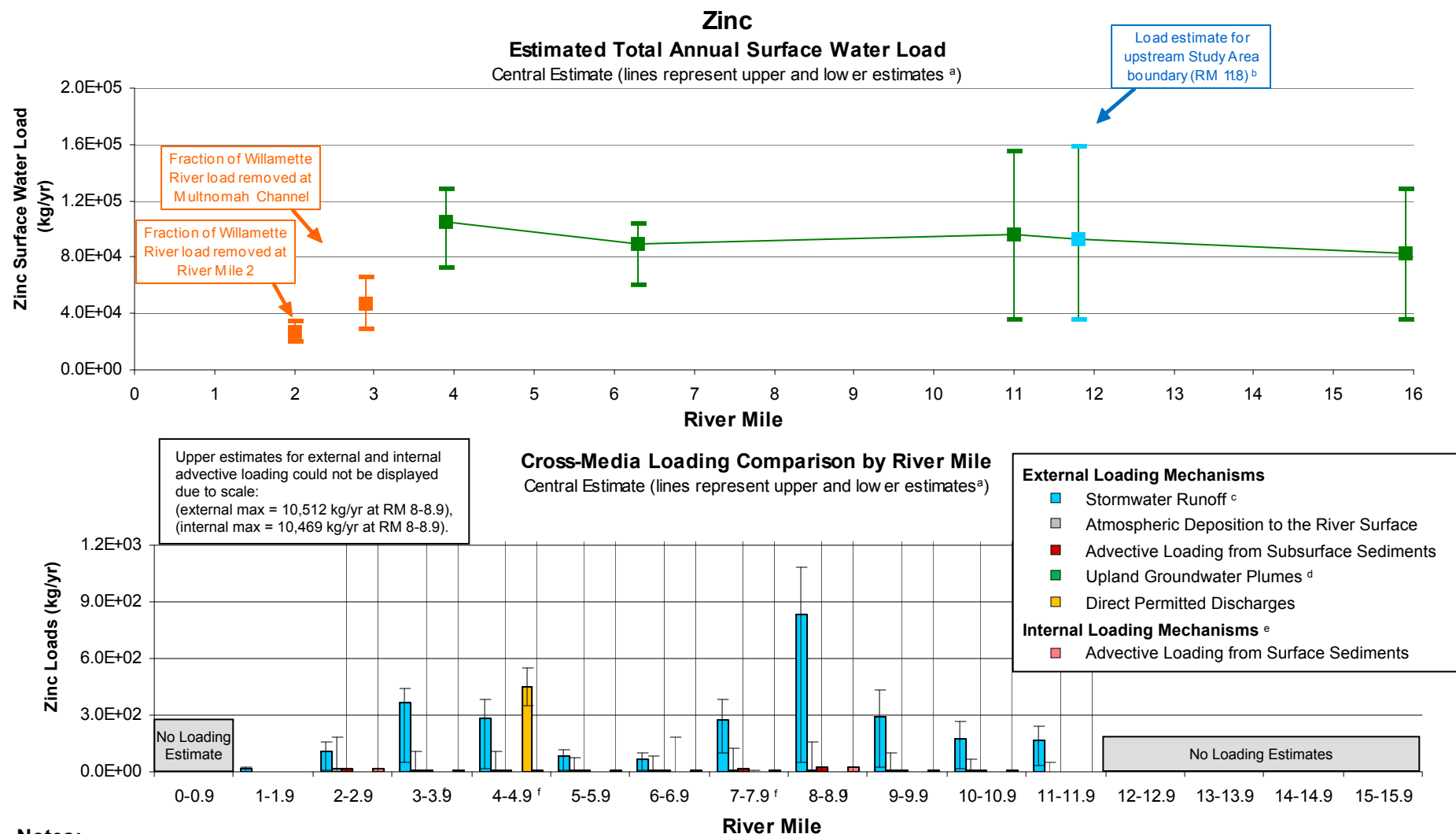
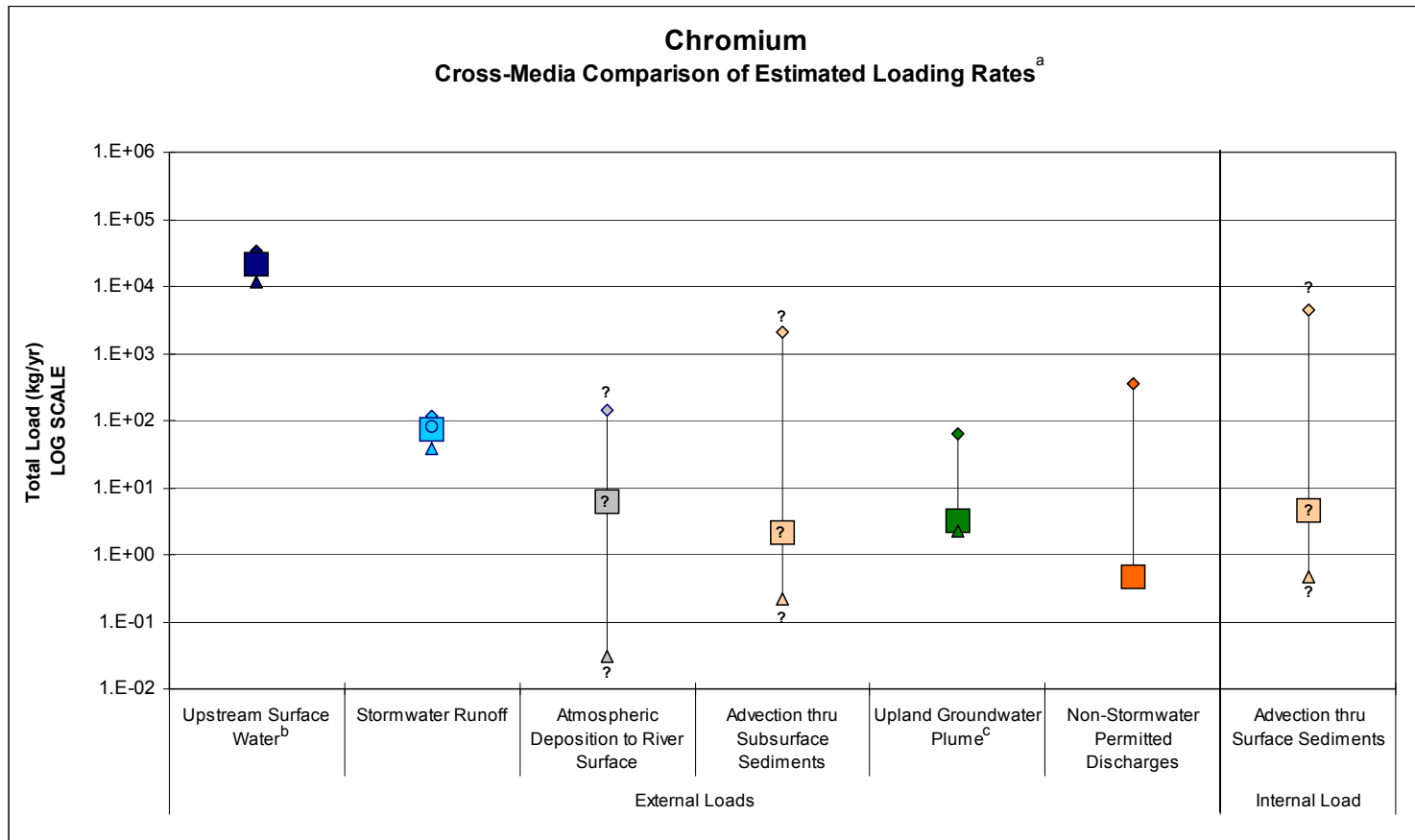


Figure 10.2-33
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Load and
Loading Comparison by River Mile
Zinc



Legend

Upstream Surface Water (RM 11.8), Total

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Stormwater Runoff

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate
- Area-weighted central estimate

Atmospheric Deposition to River Surface

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Advection thru Subsurface Sediments

- ◆ Upper estimate
- Primary estimate
- ▲ Lower estimate

Upland Groundwater Plume

- ◆ Unfiltered, central estimate
- Filtered, central estimate
- ▲ Filtered, lower estimate

Non-Stormwater Permitted Discharges

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

“?”

Indicates that the estimate is based on a combination of local data and non-local data/literature values.

“??”

Indicates that no local data were available for use in development of the estimate (based exclusively on non-local data/literature values).

Notes:

^a Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c In areas where indicator contaminants in pore water are attributable to both upland groundwater plumes and in-river sediment sources (advective loading), the plume loading estimates (based on empirical measurements of pore water flows and concentrations) include the advective load also. Note that loading estimates for the fate and transport model will not include this redundancy.

Figure 10.2-34a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Chromium – Estimated Total Annual Study Area Loads

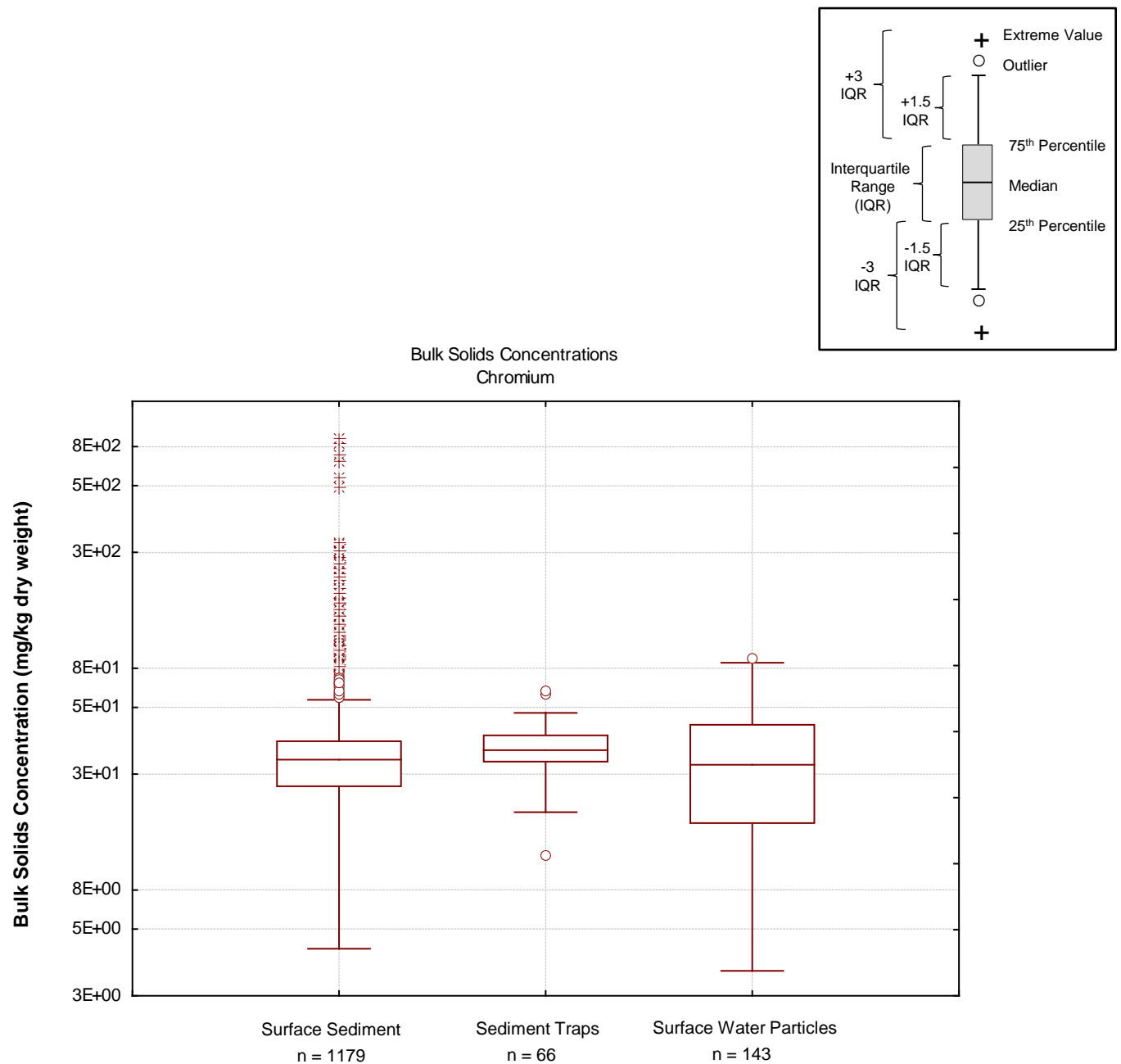


Figure 10.2-34b
Portland Harbor RI/FS
Remedial Investigation Report
Box-Whisker Plot of Chromium
Bulk Sediment, Sediment Trap,
and Particulate Surface Water Concentrations

Chromium*

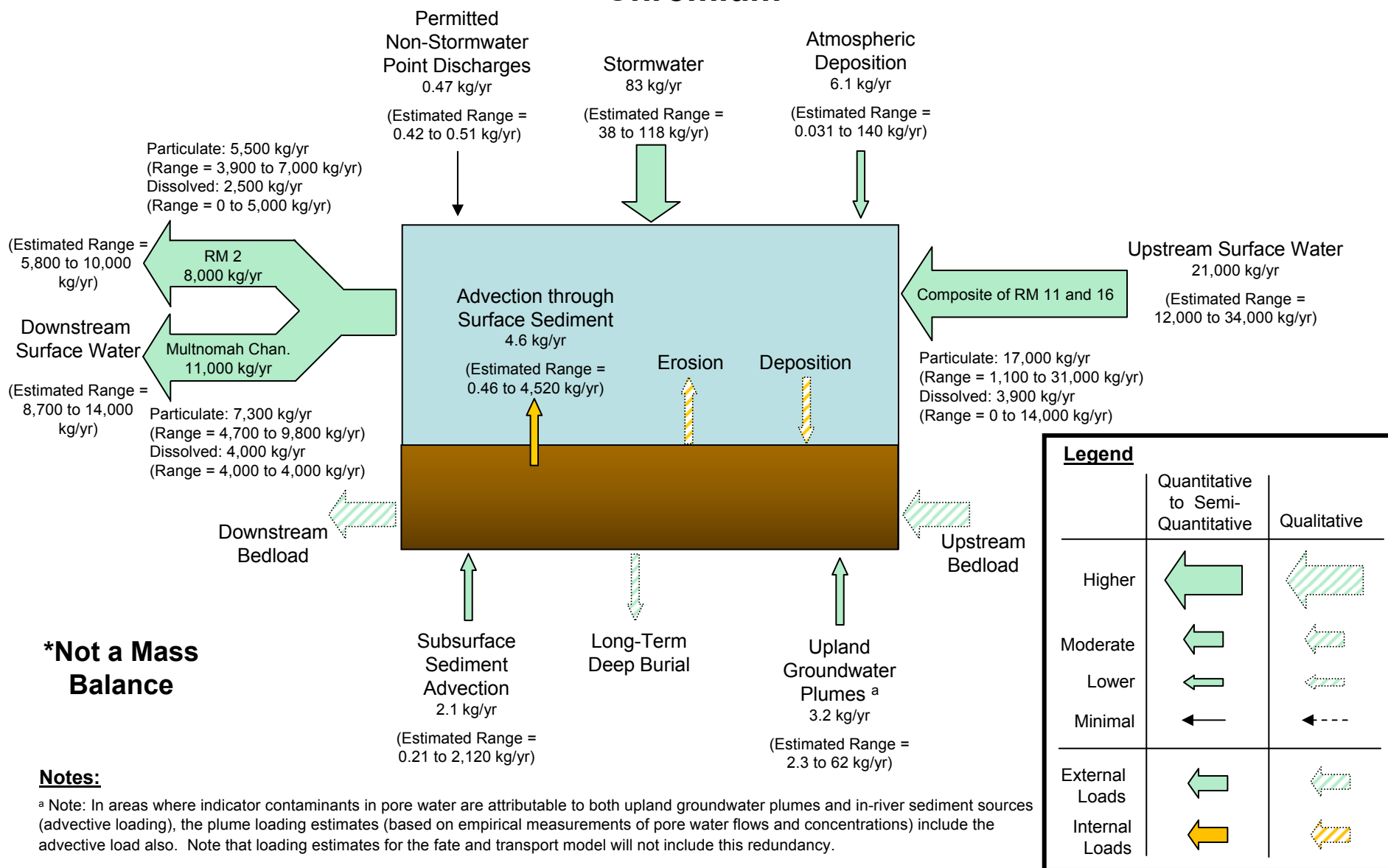
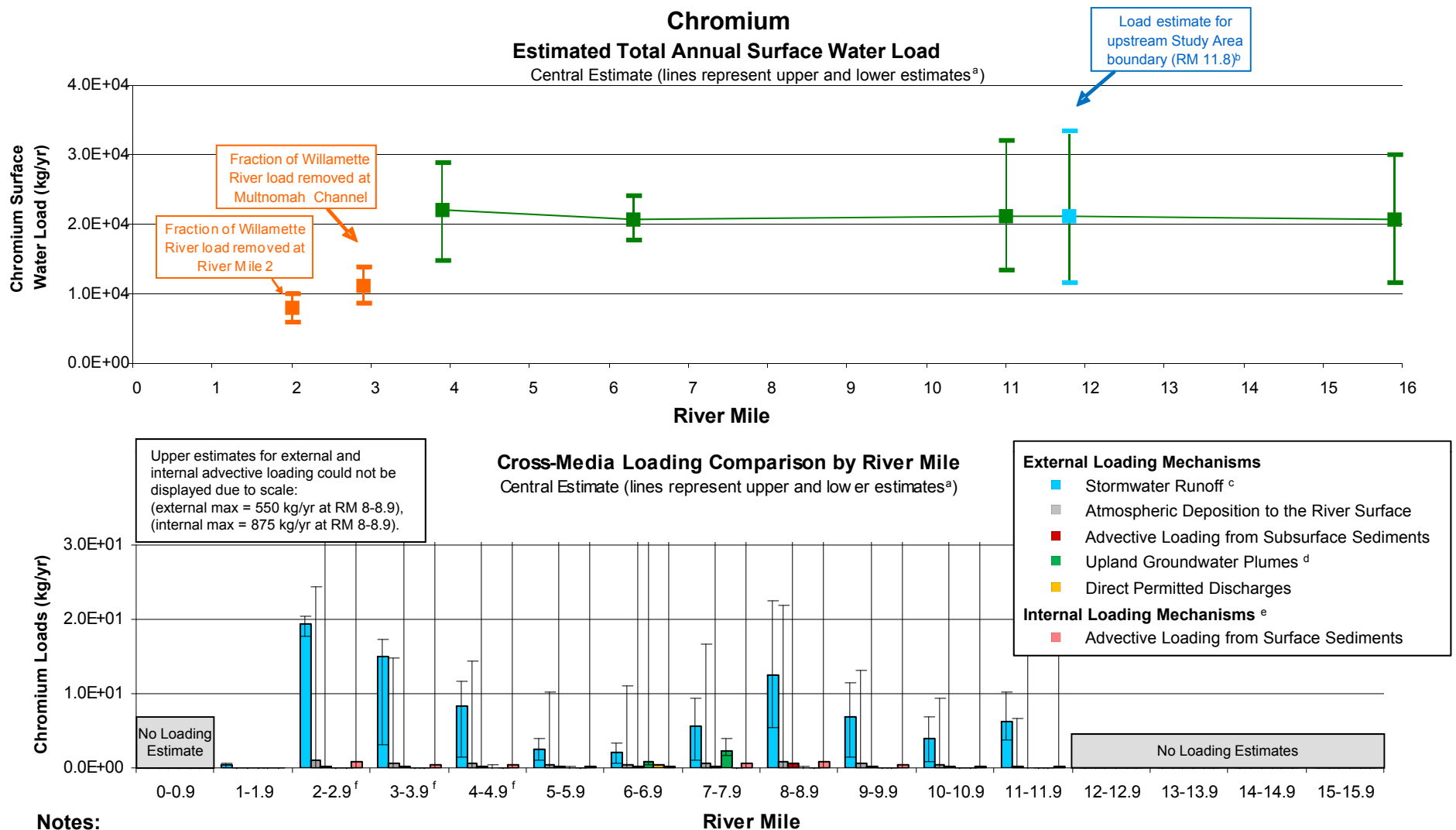


Figure 10.2-35
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
Chromium – Study Area Annual Central Loading Estimate



Notes:

^a Upper and lower estimates were generated based on available data and do not necessarily reflect uncertainty in estimate. Refer to text (Sections 6.1 and 10.2) for discussions of uncertainty in these loading estimates.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

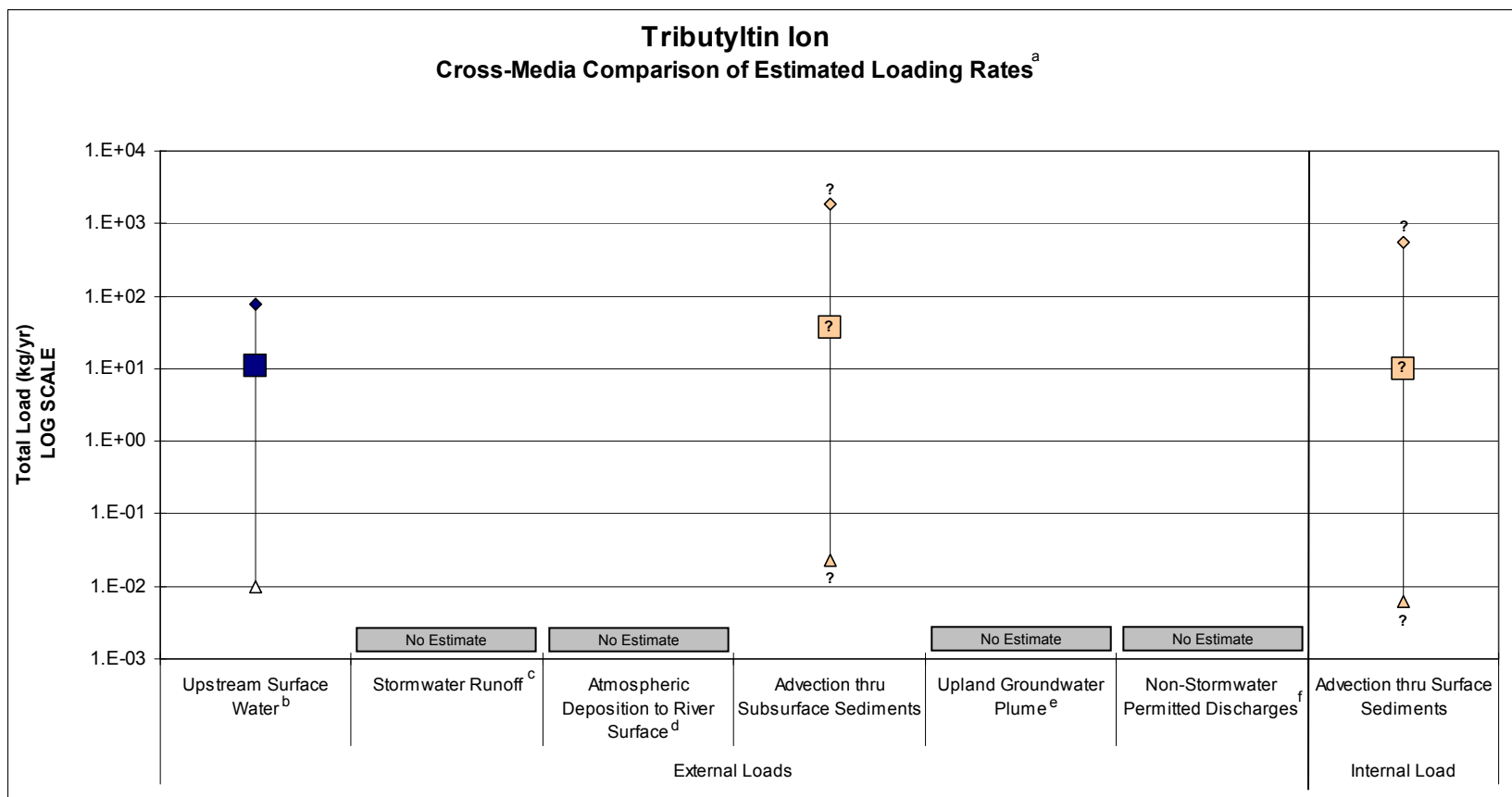
^c Stormwater estimates were generated for individual model cells rather than by river mile. Model cells frequently cross river mile boundaries; therefore, the river mile categories presented here are only approximations of stormwater runoff loading areas.

^d In areas where indicator contaminants in pore water are attributable to both upland groundwater plumes and in-river sediment sources (advective loading), the plume loading estimates (based on empirical measurements of pore water flows and concentrations) include the advective load also. Note that loading estimates for the fate and transport model will not include this redundancy.

^e Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^f Load estimate includes one or more non-representative sites which may lead to increased uncertainty related to the stormwater sampling program and load calculation methods (see Section 6.1.2.2).

Figure 10.2-36
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Load and Loading Comparison by River Mile
Chromium



Legend

Upstream Surface Water (RM 11.8), Total

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Stormwater Runoff

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate
- Area-weighted central estimate

Atmospheric Deposition to River Surface

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

Advection thru Sediments

- ◆ Upper estimate
- Primary estimate
- ▲ Lower estimate

Upland Groundwater Plume

- ◆ Unfiltered, central estimate
- Filtered, central estimate
- ▲ Filtered, lower estimate

Non-Stormwater Permitted Discharges

- ◆ Upper estimate
- Central estimate
- ▲ Lower estimate

“?”

Indicates that the estimate is based on a combination of local data and non-local data/literature values.

“??”

Indicates that no local data were available for use in development of the estimate (based exclusively on non-local data/literature values).

Notes:

Hollow symbols indicate loads calculated with sample concentrations below the laboratory detection limit. These loads were estimated at 0 kg/yr.

^a Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c The chemical was not sampled in the LWG stormwater sampling program; therefore, no loading estimates could be generated.

^d No relevant atmospheric concentration data were found for this chemical; therefore, no loading estimates could be generated.

^e The chemical was not identified as a COI for upland groundwater plumes with a known or likely complete pathway to the river; therefore, it was not included in the analyte list for TZW sampling. Consequently, no loading estimates were generated for upland plume loading for this chemical.

^f The chemical was not included for sampling on discharge permits (included permits defined in Section 6.1.3); therefore, there were no data to support loading calculations.

Figure 10.2-37a
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Comparison
Tributyltin Ion – Estimated Total Annual Study Area Loads

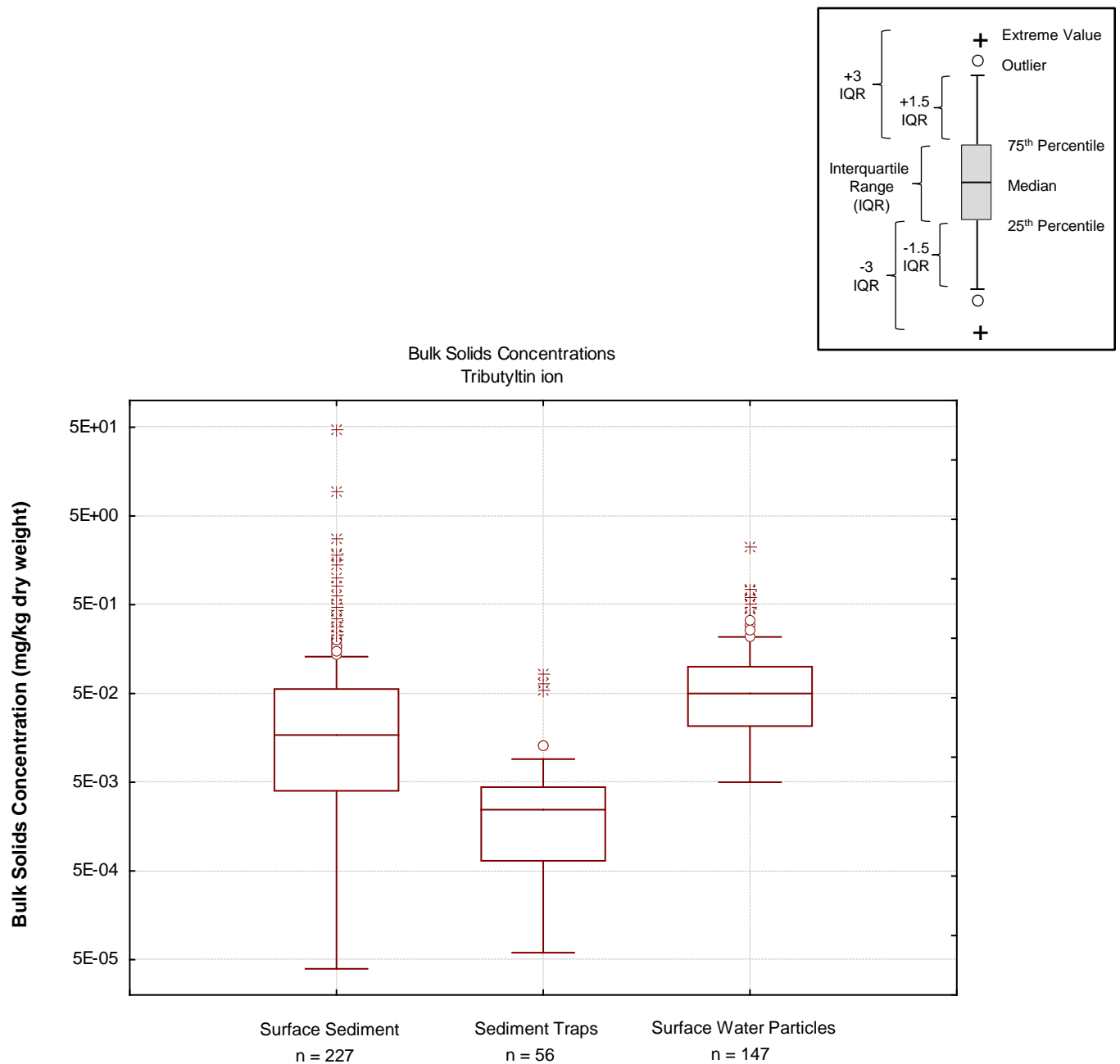
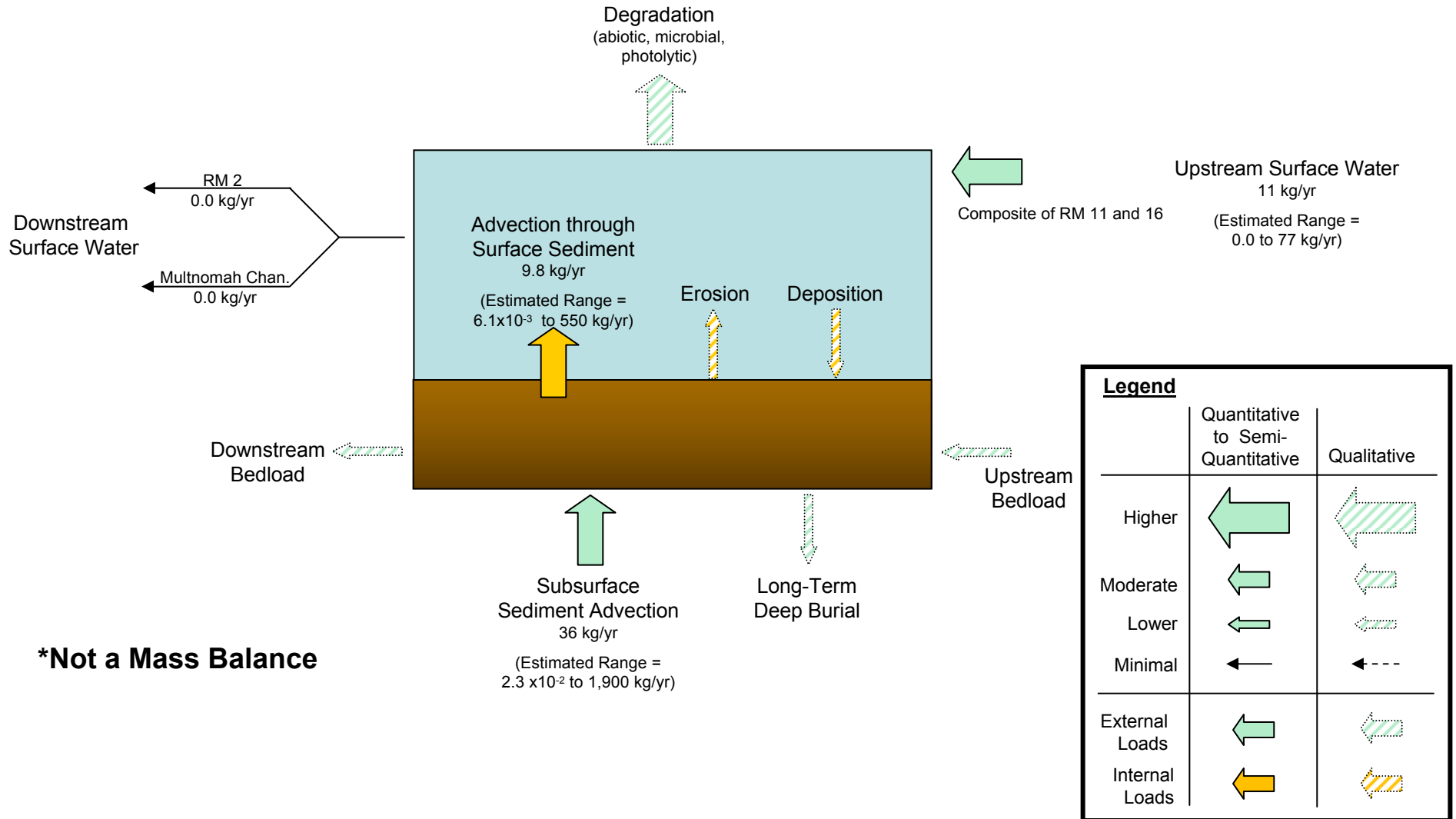


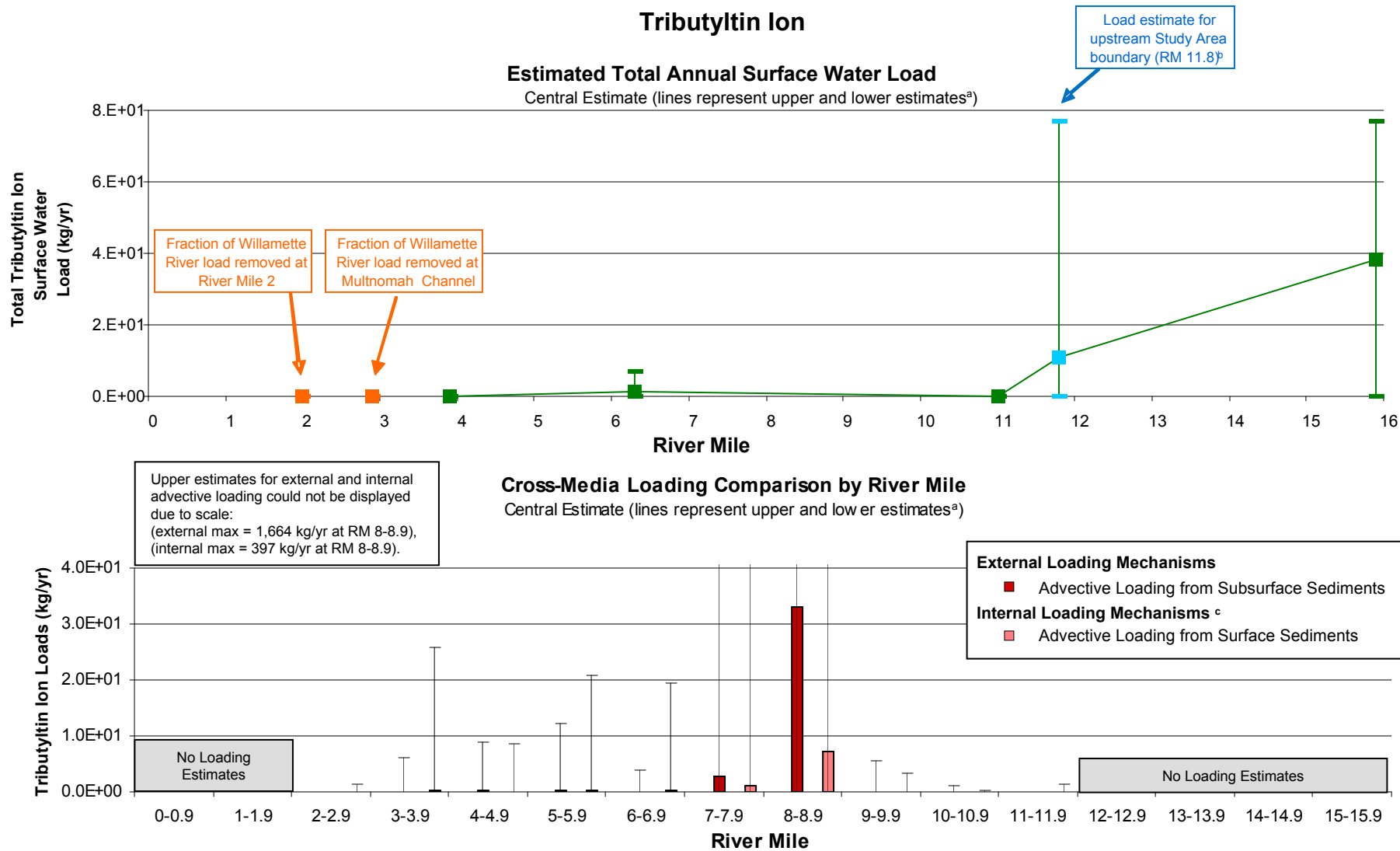
Figure 10.2-37b
 Portland Harbor RI/FS
 Remedial Investigation Report
 Box-Whisker Plot of Tributyltin Ion
 Bulk Sediment, Sediment Trap,
 and Particulate Surface Water Concentrations

Tributyltin Ion*



***Not a Mass Balance**

Figure 10.2-38
Portland Harbor RI/FS
Remedial Investigation Report
Cross-Media Loading Box-Arrow Diagrams
Tributyltin Ion – Study Area Annual Central Loading Estimate



Notes:

^a Upper and lower estimates were generated based on available data and do not necessarily reflect uncertainty in estimate. Refer to text (Sections 6.1 and 10.2) for discussions of uncertainty in these loading estimates.

^b Upstream surface water load estimated based on data from RM 16 and RM 11, with RM 11 outlying data values excluded.

^c Loading rates for internal loading mechanisms not shown on this figure, including erosion and long-term burial, will be developed from fate and transport model results.

Figure 10.2-39
 Portland Harbor RI/FS
 Remedial Investigation Report
 Surface Water Load and Loading Comparison by River Mile
 Tributyltin Ion